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THE RIVER BASIN MODEL: THE SOCIAL SCIENCE LABORATORY

Environmetrics, Incorporated

Prepared for:

Environmental Protection Agency

December 1971

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CLEAN WATER

WATER POLLUTION CONTROL RESEARCH SERIES ● 16110 FRU 12/71-13

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The River Basin Model:

The Social Science Laboratory

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COLD CREEK
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THE RIVER BASIN MODEL: THE SOCIAL SCIENCE LABORATORY,

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Envirometrics, Inc., Washington, D.C.

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The RIVER BASIN MODEL delineates an entire regional system and its interaction with water one of its subsystems. Presented is a gaming-simulation, City Model, designed by individuals who later founded Envirometrics, Inc., to provide college-level social science students with an educational technique which reverts to a more personalized education (computer assisted laboratory) and at the same time allows society to remain undisturbed by the learning process. Students are interested in actively participating in the solutions of our social ills. In the model, participants are decision-makers in one of three sectors: economic, social or governmental. A starting scenario briefly describes problems, issues, growth characteristics, housing, schools, etc. in the simulated metropolitan area. When the model is underway, the characteristics of the city will reflect the actions and interactions of the participants. The computer records participant decisions for each round and regularly provides printouts showing the interaction of decisions and their influence during the run. The model will respond to, and the play can be enhanced by, a nearly infinite variety of player actions generated by curiosity, imagination, innovation or planning, programming, and budgeting. The City Model is described in detail and full reports of its successful implementation in several American colleges are presented. (Bell-Cornell)

(See also W72-10307)

*Urban sociology, *Education, *Regional analysis, *Decision making, *Computer models, Computer programs, Social aspects, Political aspects, Governments, Economics, Water resources.

Gaming-simulation.

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THE RIVER BASIN MODEL:

The Social Science Laboratory

by

Envirometrics, Inc.
1100 17th Street, N.W.
Washington, D.C. 20036

for the
Office of Research and Monitoring
Environmental Protection Agency

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Chapter I

Findings and Recommendations

Following is a summary of the findings and recommendations of this study:

1. It is possible to use one model to teach a variety of social science subjects. This fact does not appear to vary regardless of class size or whether the participants are graduates or undergraduates.

2. The presence of a social science laboratory in an ongoing curriculum requires substantial changes in course context or the addition of a new course.

3. The inclusion of a laboratory cannot be done without some help from a colleague or a graduate student. Further, the decision to use the tool will require a considerable time and effort expenditure on the part of the professors using it.

4. Unanimously, the tool was considered a valuable addition to the conventional discipline courses. This finding was affirmed by both the professors and the students.

5. The model must be installed on the campus for really effective use. This would mean that the model could be more fully utilized and that the faculty and students could experiment with it.

6. There were no books available to the contributing professors to help them in teaching the model as the relation of this discipline to a total system.

In summary, the experiment indicated that the social sciences are now ready to use a computer assisted laboratory to teach their subjects. However, this laboratory must be packaged better and made available to local universities and colleges so that they may carry on individual experimentation as part of their normal educational programs. The results of the study showed the success of the use of the model as a pedagogical device but also showed the almost utter futility of trying to service its use from a single centralized location.

Chapter II

Introduction

Today, social science education is in the midst of a severe cultural lag. Its students, responding to the needs of our society, are interested in becoming active participants in the solutions of our social ills. They appear to prefer this activist role to the more traditional one of the passive scientist who studies the system from afar. Unfortunately, although our educational institutions will at least begin to prepare students for the latter, they usually do not possess techniques for preparing them for constructive participation in day to day affairs.

Possibly a partial explanation of this failing can be found in the evolved structure of the educational institutions themselves. Unfortunately, there is little for the historian and anthropologist to use to re-create the path of evolution through the ages. Consequently, we shall be forced to hypothesize the growth of this institution in Western Civilization.

When the number of people gathered together in a group or clan is small, and when the technology they have at their disposal is primitive, the society (depending on the niggardliness of nature) is usually forced to spend large amounts of its energy in matters of survival per se and therefore spends little in speculative or educational activities. The young men or women, when time comes for them to participate actively in the group's survival, are apprenticed to older members of their own sex (normally in their own kinship group) to learn by mimic the techniques they will use throughout life. It is not until the technology improves and the group's number increases, that specialization in education is able to come about.

For our convenience, let us picture this evolving rudimentary formal educational system as being divided into two distinct categories. The first, a manual-technical classification which includes a teaching of all of the skills required to support the culture in its day to day existence. In the case of teaching these skills it would appear that the more routinized the skills required and the greater the number needed to perform the operations, the more likely it is for the task to be turned over to some form of formal educational institution rather than to be apprenticed to single individuals. Subsumed under this category could be such training operations as manual trade schools, guilds, military academies, and so forth.

A second category can be broadly classified as philosophy. This group of studies was instituted to cater to the needs of the ruling and wealthy classes. Since there was little chance that the young of these groups would ever need to perform manual labor, they were taught how to govern and how to address themselves to the more abstract problems of life. Often these schools specialized in religious training or in the arts such as music and painting.

Classes in both schools were likely to be small, and the amount of accumulated tribal knowledge to be passed on to the young was relatively light. The seminar and laboratory (shop) could be widely used, resulting in a great deal of personal attention for the student. Further, secondary sources such as books were scarce so that the student could not be totally separated from everyday experience; his laboratory had to be his world -- as interpreted by his teacher, of course.

As educational institutions became more crowded and as the accumulated knowledge of a society increased, the schools had to search for methods of educating its students in a more streamlined fashion. For example, many of the frescoes on the walls and ceilings of the 13th and 14th century buildings in Europe were painted by a master and his students. Such a practice is possible only if the number of students is small and the master can see to each in an apprentice fashion. For many decades we attempted to maintain this concept of master-student by separating the vast number of students seeking knowledge into undergraduate and graduate levels. The lower level catered to its clientel through mass-produced learning situations. Only the best from this level were allowed to be taught in a tutorial sense.

Ancillary with the overcrowding of the educational sphere has been the evolution of the researcher. As more and more students demanded the benefits of an education, the demands placed on the teacher increased to provide unique tutorial discussions of the day to day environment. Further, more and more teachers discovered a continuing demand for a few of their seminars (based on their own experience and observations) to the end that there was both a desire and a demand for widespread distribution of their teaching. Soon, the dual phenomena of an expanding day to day environment and the teacher's capability of explaining it, led to the creation of a middleman, the researcher. The researcher attempted to antiseptically describe and relate a number of different environments and facets thereof to be used by the teacher and his students in place of first hand experience. In short, we evolved a body of men whose specialty is the distribution of observations of the real environment in such a fashion as to provide an artificial, but rich situation for the teacher and the student as they go about the study of philosophy.

It appears that this trend, although seemingly logically arrived at from a historical point of view, has worked to the disadvantage of the modern student. In truth, today's graduate student is the victim of both overcrowding of our educational facilities and the loss of a tutorial teacher. His teachers have taken the road of the researcher as the most rewarding and have abandoned him to read their musing rather than join in the study. Although his predecessors had the distinct advantage of practical studies under a master, he finds himself relegated to the role of the former undergraduate as his numbers have grown to a point where it is impossible for modern educational facilities to handle him as a unique individual. Since, as noted earlier, our educational institutions led the student to expect some degree of private attention and activistically oriented research as he progresses in his education, the lack of these ingredients leads to a great deal of frustration. The solution at first blush appears quite simple. All that is required is to reverse the evolutionary tendency so that the modern student can participate in real life problems under the tutelage of a guiding teacher.

Unfortunately, however, self-evident as such a solution might be, we are constrained by the fact that it is impossible for all of the vast number of students of social science (part of modern day philosophy) to be unleashed upon the day to day world. What is needed is an educational technique which will revert to a more personalized education and at the same time allow society to remain undisturbed by the learning process.

Chapter III

Objectives of the Study

When developed, the proposed operational simulation education program would make an important contribution to college-level social science teaching. Financial support was needed so that the program could:

1. demonstrate that operational simulations by compressing both time and space can make complicated patterns of interrelationships understandable to students and researchers in the field of urban development.

2. refine comprehensive operational simulations for teaching. These simulations, by holistically revealing economic, social, and political variables in a metropolitan area, make courses meaningful to a student than have more traditional methods.

3. adapt the CITY Model to extensive classroom use in interdisciplinary or other social science courses in urban affairs and analysis so that it could be used:

    (a) as the basic teaching device in a course, or
    (b) as a means of illustrating specific principles or relationships.

Chapter IV

The City Model

How the City Model Operates

In the model, participants (usually from twenty to one hundred) are decision-makers in one of three sectors: economic, social or government. The metropolitan size, geographical configuration, and political jurisdiction boundaries are chosen before play from several alternatives.

Cu-rently available are ten starting cities, ranging in population from 10,000 to 1.6 million. The simulated metropolitan area comprises 625 parcels, each representing one square mile (or one-ninth of a square mile), many of which are unowned at the beginning of play. (See Figure 1)

A starting scenario may be used which briefly describes the current status of the area in terms of problems, issues, characteristics of growth, stability or decline, status of services, housing, schools, traffic, tensions, conflicts or plans. When the model is underway, the characteristics of the city will reflect the actions and interactions of the participants.

The computer records participant decisions for each round. It indicates the effects of decisions on one another and on the metropolitan area itself. Regularly provided computer printouts show the interaction of decisions and their influence during the run.

The CITY MODEL will respond to, and the play can be enhanced by, an almost infinite variety of palyer actions generated by curiosity, imagination, innovation or planning, programming, and budgeting. A general description of decision-making power of each sector follows:

Economic Sector Action

Economic decision-makers have many choices of action. They are managers of their existing resources and have opportunities to expand their holdings. They may purchase and develop unowned land parcels or buy owned parcels from other economic decision-makers during a simulation run.

CITY OPTIONS

FIGURE 1

BASIC CHARACTERISTICS					
CITY NAME	METROPOLITAN	TRICITY	DUNBEATH	LOTHIAN	MORAY COUNTY
POPULATION	1,548,500	601,000	275,500	50,000	11,500
POPULATION SCALE	P1 = 500	P1 = 500	P1 = 500	P1 = 50	P1 = 500
TOTAL MARKET VALUE OF PRIVATE DEVELOPMENTS (in millions of $)	9,286	2,504	90	14	9
PUBLIC DEBT (in millions of $)	336	355	39	13	8
NUMBER OF DEVELOPED PARCELS	245	136	59	173	19
CPU TIME	17 minutes	5 minutes	3 minutes	6 minutes	2 minutes
PAGES OF OUTPUT	260	280	220	240	160
FIXED MODULES					
JURISDICTION	2	3	1	1	1*
STARTING ECONOMIC TEAMS	10	10	7	10	4
MAXIMUM ECONOMIC TEAMS	10	10	7	10	10
SOCIAL TEAMS	10	10	7	10	10
USABLE MODULES (Starting)					
RAIL	Yes	Yes	No	No	No
BUS	Yes	Yes	Yes	Yes	No
PREEMPT LAND	Yes	Yes	No	Yes	No
PUBLIC INSTITUTIONAL LAND	No	Yes	Yes	No	No
LOCAL CONSTRUCTION INDUSTRY	Yes	Yes	Yes	Yes	No
ASSESSMENT	Yes	Yes	Yes	Yes	Yes

*The director has control over two additional jurisdictions, each of which is composed of four parcels (square miles).

As managers of economic enterprises, they are faced with many decisions. Besides setting wage, price and production capacity structures for their properties, decision-makers also may decide to earn income from funds invested on cash subsidies, borrow and lend money, and, of course, have to budget for taxes.

Economic decision-makers can operate individually or in concert with other economic interests to create economic development plans, industrial parks, revitalization of a downtown area, among other things. They may also cooperate with city programs or actively oppose them.

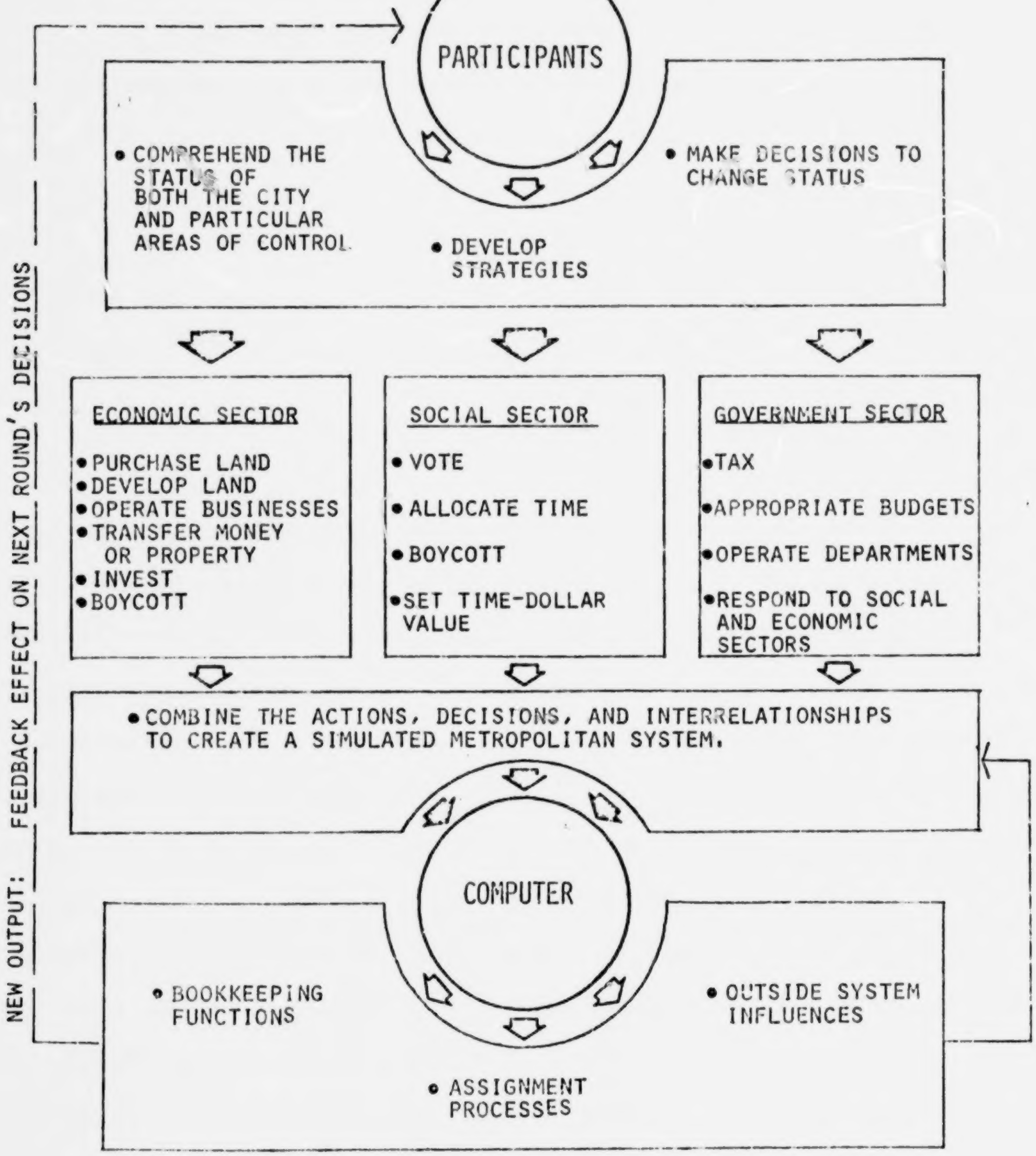
There are four major types of economic activity in the Model:

Basic Industry - Heavy Industry (steel plants, for example), Light Industry (electronics firms) and National Service Industries (local outlets or plants of national concerns). These activities spend money for business goods, business services, utilities, maintenance services and transportation, to produce output that is sold in national markets at prices determined by the national business climate.

Commercial Establishments - Business Goods (suppliers of hardware and raw material, for example), Business Services (insurance), Personal Goods (consumer hardware) and Personal Services (supermarkets).

Figure 2

INTERRELATIONSHIPS IN THE CITY MODEL


PARTICIPANTS
• COMPREHEND THE STATUS OF BOTH THE CITY AND PARTICULAR AREAS OF CONTROL
• DEVELOP STRATEGIES
• MAKE DECISIONS TO CHANGE STATUS
ECONOMIC SECTOR
• PURCHASE LAND
• DEVELOP LAND
• OPERATE BUSINESSES
• TRANSFER MONEY OR PROPERTY
• INVEST
• BOYCOTT
SOCIAL SECTOR
• VOTE
• ALLOCATE TIME
• BOYCOTT
• SET TIME-DOLLAR VALUE
GOVERNMENT SECTOR
• TAX
• APPROPRIATE BUDGETS
• OPERATE DEPARTMENTS
• RESPOND TO SOCIAL AND ECONOMIC SECTORS
• COMBINE THE ACTIONS, DECISIONS, AND INTERRELATIONSHIPS TO CREATE A SIMULATED METROPOLITAN SYSTEM.
COMPUTER
• BOOKKEEPING FUNCTIONS
• ASSIGNMENT PROCESSES
• OUTSIDE SYSTEM INFLUENCES
NEW OUTPUT: FEEDBACK EFFECT ON NEXT ROUND'S DECISIONS

Construction Industry - Negotiates contracts with economic and governmental decision-makers, builds or upgrades developments with the requisite labor and material.

Residences - Single family dwellings, garden apartments (or multiple dwellings) and highrise structures. They may be developed to various densities and for three socio-economic classes. Decision-makers here are landlords, who spend money for maintenance, utilities, and taxes and earn income based on the rent charges and the number of occupants residing in the buildings.

Social Sector Actions

Social sector participants make decisions for population units (people) who inhabit the metropolitan area. These decision-makers allocate time for their groups (that is, to spend extra time at work, in education, politics, or recreation), boycott or strike (not to shop or work at certain businesses, or not to use certain modes of travel), and to vote (for elected officials or referenda).

Participants review their social status for the socio-economic groups they represent. They make decisions as to how they will vote, use their time and perhaps boycott so that they can improve their position. Raising the educational level, for instance, increases job opportunities and income potential.

An important part of the model's social action is the ad-hoc or special issue pressure and agitation exerted by the social sector decision-makers. Often, low socio-economic groups take concerted action to get the economic sector to create more jobs or to get the government sector to improve their schools or municipal services, or to encourage the development of education parks, for instance.

Government Sector Actions

Government sector positions are: Chairman or Mayor; Councilman; Assessment; School Department; Municipal Services; Highway Department; Planning and Zoning; Utility Department; Bus and Rapid Rail.

These decision-makers are elected by the social decision-makers or appointed by the already-elected officials to assume the duties of the governmental functions, which are performed simultaneously with the economic and social functions. The elected officials must satisfy voters in order to stay in office each round. The chief elected official in each jurisdiction appoints others to execute the functions of the school, municipal services, highway, planning and zoning, and assessment departments.

The government departments build schools, provide municipal services, build and upgrade roads and terminals, maintain roads, buy and develop parkland, zone land, and estimate revenues. The players decide whether or not utilities, bus and rapid rail functions may be operated publicly or privately.

Other Roles

Other roles which may be interjected into a run of the CITY MODEL include: Mass Media, Citizens Advisory Group, Federal-State-Aid Officer; and Deputy Mayor and many others.

The City Model in Action

A sector by sector description of the CITY MODEL cannot fully portray the dynamic interactions of the participants which occur during the simulation, nor can it show the increased awareness of urban system interrelationships which is a major outcome of participation.

However, a brief description of a hypothetical round may illustrate some of the excitement and realism of the interactions.

A Sample Round

Early in the Round participants are reviewing their computer output and trying to order their possible actions into priorities.

Economic decision-makers will probably bid on unowned land or acquire desirable land from other participants, attempt to secure loans from local or outside bankers, apply for zoning changes, request utility expansions, and pressure for expanding highway access.

Simultaneously, social decision-makers may be bargaining for higher wages, requesting improvements in local schools and municipal services, and trying to promote the politicians who offer a favorable platform for upcoming elections.

The government officials are receiving the requests from economic and social decision-makers to lower taxes, improve the schools, provide better municipal services, expand highways in several different directions, to build additional utility facilities, enlarge the park system, and, possibly, to lower bus and rapid rail fares while improving services.

Naturally, the budget officials are faced with the difficult task of finding sufficient revenue to meet the expanding public needs and dividing the local appropriations pie among the many departments -- all of which have attempted to justify expanded budgets.

Midway in the Round a majority of the decision-makers realize that all their desires will not be fulfilled. They will have to make trade-offs and bargains.

The elected officials begin to worry about staying in office. The departments attempt to make do with sub-optimal appropriation levels. The assessment office tries to minimize the public resistance to changing assessments.

The low-income representatives endeavor to marshall some political clout. The high-income representatives attempt to maintain their status.

Businessmen look for shortcut methods of reducing their losses and increasing their activity in profit-making ventures.

Toward the end of the Round the participants seal the bargains they have struck; continue to make decisions for the computer to act on; finish negotiations on construction contracts, new wage levels, new prices, and new rents; spend current and capital appropriations; allocate leisure time to various activities; carry out boycotts; and complete any of the other possible actions.

At the Round's end, the participants may campaign and carry out new elections, hold town meetings, debrief their actions, and/or take a rest break while the computer is preparing a new printout showing how the metropolitan area responded to their decisions.

The Director

The director of a play of the City Model may select the starting city configuration used by the participants, change a number of conditions in the city before the start of play, and have a continual effect on the play through the use of the many director options. These options are described briefly in Figure 3.

The game director may select one of several initial starting configurations representing rural and urban areas of varying sizes. In determining what city to use, the director

DIRECTOR OPTIONS

FIGURE 3

Reproduced from best available copy.

Decision Type and/or Director Option for Pre-Round 1 Adjustments	Sector Directly Affected	Basic Results of Action
Vary number of in-migrants[1]	Social	Population by class increased or stabilized
Choose construction facility Local Construction Industry	Economic, Government	Round lag for completion of construction projects (each takes one year to build). Player operation of CI including: negotiation of contracts; local employment, etc. Local CI is choice unless director specifies otherwise.
Construction, Demolition[2]	Economic, Government	Developed area of city is changed.
Cash Transfer	Economic	Round 1 cash balance can be altered. More cash usually leads to more developments.
Cash Transfer	Government	Operating subsidies provided or great budgetary pressure applied to departments.
Public Land (Preempt)	Economic	Land made either undevelopable or open for developments if land was previously undevelopable.
Decisions normally under player control	Social, Economic, Government	Alter use indices (change employment); wage and/or price structure changed; improve or hamper public services, etc.

---

[1] Since the migration routine is first operated at the beginning of round 2, this director option may first be exercised during LDIT before round 2.

[2] Decision-maker for whom construction and/or demolition is being contracted must have sufficient funds in his account. Note that in none of the starting [illegible] industry have outstanding contracts (including the [illegible] (Round 1 LDIT), no construction industry will receive income [illegible] appear in Round 2 in the case of YISCI or in Round 1 in [illegible].

considers the factors summarized in Figure 3, which describe the varying sizes and scales of optional cities.

Decisions in the City Model

The model's vastness may be illustrated by the type of decisions available to its users. While it is not the purpose to fully discuss the model here, the description below gives an idea of the model's comprehensiveness.

Economic decision-makers may make any or all of the following decisions during any round of action:

Bid on and Possibly Purchase Land Owned by Real Estate Interests That are Simulated by the Computer. Each round, several parcels of this outside-owned land is put up for auction and sold to the local decision-makers (economic or government) who bid the largest amount over the asking price. Other outside owned parcels of land are sold to the local decision-makers (economic or government) who bid the largest amount over the asking price. Other outside owned parcels of land are sold to participants who bid on them and purchase them on a probability basis that is affected by the location of the land and the amount of the bid.

Purchase Land from Other Local Decision-Makers. Land may be transferred between local decision-makers under mutually agreeable conditions.

Borrow Money from Outside Lenders, or Borrow or Lend Money. The interest rate on outside loans is influenced by national business conditions, whereas the interest rate on local loans in mutually determined by lender and borrower.

Transfer Cash to the Account of Any Other Economic or Governmental Decision-Maker. A cash transfer has no strings attached as far as the computer is concerned. Participants must themselves enforce any conditions attached to cash transfers.

Build (or Demolish) One of the Eleven Economic Business Land Uses on an Unowned Portion of a Parcel of Land. Each of the businesses has specific land requirements, utility service requirements, and zoning qualifications that must be satisfied before development can take place. Construction can be carried out by a local construction industry (CI) through negotiations with an economic decision-maker that owns a CI or by an outside CI at 30 percent above normal development costs.

Change the Maintenance Level of Economic Activities. The maintenance level measures the amount of upkeep and maintenance that is performed on plant and equipment. A low maintenance level means that the owner is not willing to spend much money to keep the business in a state of high maintenance. The economic effectiveness of a business increases with a high maintenance level.

Change Salary to Employees. Owners of basic industry (HI, LI, and NS) and commercial establishments (BG, BS, PG, and PS) and the construction industry (CI) hire labor force. The number and type of workers hired may be affected by the salary level offered.

Change Rent Charged to Residents of Housing Units. Owners of residences (RA, RB, and RC) set rent levels for potential residents. The rent level affects the number and type of residents living in a housing unit during any given round.

Change Prices at Commercial Establishments. Owners of BG, BS, PG, and PS establishments set a price for a unit of goods or services sold. The amount of sales is a function of the price as well as the amount of potential customers and competitive suppliers. Owners of CI establishments negotiate the costs of construction with interested developers.

Boycott Shopping at BG and BS Establishments. The owners of economic activities that purchase goods and services from BG and BS establishments may refuse for any reason they wish to buy from particular establishments.

Social Sector Actions

Social decision-makers receive computer output at the beginning of each round of play. The social output lists by population class the place of residence, educational level, voter registration, dissatisfaction index, income, expenditures, and time allocation for the population units controlled by each social decision-maker.

Participants review their social status and make decisions for the coming round as to how they will vote, allocate time, and boycott so that they can change their elected officials, income, education level, dissatisfaction index, or any other set of objectives they wish to achieve.

Vote for Elected Officials and Local Referenda. Social decision-makers have voting power that is dependent upon the number of population units they control by income class, the voter registration levels of their population units (based on the amount of time spent in political activity), and the amount of campaign donations.

Allocate Leisure Time Among Four Types of Activity. Social decision-makers allocate 100 units of time for each population class to a combination of four activities: extra work, adult education (free or pay), politics, or recreation. Any time spent in transportation to work is automatically deducted from the 100 units of time. Time units allocated to extra work or education which is not actually spent in one of the uses (either because extra work was not available or because public adult education was not available) then becomes involuntary time and causes the dissatisfaction index to rise.

Evaluate a Unit of Time in Terms of Money. Social decision-makers place a dollar value on a unit of time for each of the population classes. The computer then uses this dollar value of time and adds it to the dollar cost of travel by mode to achieve an overall minimum cost when assigning modes of transportation to population units going to work locations.

Boycott Jobs, Stores, or Modes of Travel. Social decision-makers have an option to refuse to have any of their population units work at any employment location, shop at any personal goods or services establishments, or use the bus or rapid rail systems to travel to work.

One of the most important indicators of social welfare is the dissatisfaction index. This index for a population unit increases if there is a decrease in the quality of the unit's housing, if the unit is not served by local schools or municipal services, if its local taxes are excessively high, if rents are above normal, if the population unit is unemployed or under-paid, and if the unit has involuntary uses of time. High dissatisfaction leads to migration either to another part of the metropolitan area where dissatisfaction will decline or to the outside system.

Government Sector Functions. Government decision-makers are either elected (chairman and councilmen) or appointed (assessment, school, municipal services, highways, and planning and zoning departments). Governmental decision-makers may also be in charge of the utility, bus and/or rapid rail departments if they are publicly operated. Each of the governmental decision-makers (designated by CH for chairman, CO for councilman, AS for assessment, SC for schools, MS for municipal services, HY for highways, PZ for planning and zoning, UT for utilities, BU for bus, and RR for rapid rail, respectively) receives computer output at the beginning of a round. Participants review this output for the current round and future rounds. The following decisions may be made by the indicated decision-makers.

Allocate Capital and Current Funds, Subsidies, and/or Cash to Each Department. - Chairman and Council. Each department has expenses that must be paid for with funds appropriated through the budget process.

Change Tax Rates on Land, Developments, Resident Income, Employee Income, Resident Auto Expenses, Employee Auto Expenses, Sale of Goods and Sale of Services. - Chairman and Council. Local tax revenue comes from taxes levied on a combination of the eight tax bases.

Set the Level of Welfare Payments - chairman and council. Unemployed population units receive unemployment compensation at the rate designated by the local elected officials.

Change Assessments - assessment department. Assessments can be changed for special assessment zones, the rate of assessment increase, and the assessment ratio on land and developments.

Purchase or Bid on Land - school, municipal services, highways, planning and zoning, utility, bus and rapid rail departments. Land is required for public buildings, rights-of-way, and parkland.

Condemn Land - school and highway departments. Owners of land that has been condemned may appeal the condemnation. Final settlement is made by the chairman and council.

Change Employment Level - school and municipal services departments. The number of population units hired as teachers and government workers may be changed in response to the needs of the community.

Change the Maintenance Level of Buildings or Equipment - school, municipal services, highways, bus and rapid rail departments. The maintenance level affects the effectiveness of government facilities.

Make Contracts for BG and BS Purchases - school, municipal services, highways and rapid rail departments. These departments may specify the establishments from which they wish to purchase goods and services.

Request Federal-State Aid for Capital Expenditures - school, highways, and planning and zoning departmenrs. Federal-state aid for current expenditures is allocated on the basis of population for the school and municipal services departments.

Change Boundaries - school and municipal services departments. Students and population units are served by the facilities provided for their district. The district boundaries may be changed to take into account population dynamics.

Change Zoning - planning and zoning department. A master plan may be implemented using the zoning powers of the local government.

Change Mass Transit Routes - bus and rapid rail departments. The location, direction and amount of bus and rapid rail service may be changed by the appropriate authorities.

Set Mass Transit Fares - bus and rapid rail departments. Fares may be established on a per passenger, per zone, or per mile travelled basis.

Construct or Demolish Buildings or Transportation Linkages - school, municipal services, highways, utilities, and rapid rail departments. Construction may be performed by local construction industries at negotiated prices or by outside construction industries at fixed prices.

Add or Change the Level of Utility Service - utility department. The amount of utility services (power, water, sewerage, etc.) that can be supplied to a parcel of land is dependent on the level of utility service provided.

Chapter V

The Meetings

For the first and second meetings with the participants we met to discuss problems with the study and to try to discover methods of improving the runs. The third meeting was summarial and merely focused on the task itself.

The discussions were carried out very informally with a representative of NSF present. Following are some of the topics discussed.

A. There did not appear to be any easy method of introducing the material contained in the model. We loaned the participants two film documentaries of the games produced by NBC. Further, we made available a number of slides and tried to teach the participants how to introduce the model.

   As a result, the first few months of the run were a tribute to the tenacity and integrity of the professors as they stumbled and fought their way through the model with the students. The second time around was considerably easier as the professors devised their own teaching formats and personalized the introductory lectures. One professor devised his own visuals of the City and his students produced a video tape designed to teach the model.

B. All of the participants had to change the reading lists assigned to their courses. They found that the syllabus used previously was no longer adequate to incorporate the breadth of subject matter covered with the laboratory.

C. They all found that the model ran best when the political leader was dynamic and aggressive. Also, unless the professor began to make active use of the model to demonstrate theories or to allow innovative decision-making, the students became bored because they had learned many of the mechanics of the model by the fourth or fifth round.

D. The students tended to take over the lab as a source of self-study. One theme became clear: there should be a central laboratory which would allow students and professors continuous access to the model, regardless of course.

E. The users felt that there was a need for more information which was not provided by the model. Consequently, everyone used a form of mass media, including one or more newspapers and a video tape.

F. The model was too much for the professors to run themselves; consequently, each professor had to obtain help from the participating students or faculty or assign one of their graduate students to the project.

G. All of the users found that the model ran better the second time if a general goal or strategy for the students was pre-assigned.

H. There were a number of difficulties with misunderstood or mispunched input cards on one hand and poor turnaround on the other.

I. There was a general need for a visual of some sort to be used by the players so that they could see the importance of their decisions.

J. At the end of the first meeting, the users discovered that they had only played the game from one of an infinite number of possible starting positions. They all opted to continue with the same starting position rather than a new one, however, as they did not feel confident enough to tackle a quantum jump in complexity so early in the game. One professor did continue his city development rather than begin again.

K. The professors all ended with a feeling that use of the model would be a part of the next year's courses and that it would not be difficult to run. The amount of time that they were required to expend to learn the model was considerable. In fact, one or two said they might not have taken part in the project had they known that it would have taken so much time. However, at the end of the project, they felt that the time expenditure was well worthwhile.

L. A social science laboratory is to remain at least at three of the schools and is to be used not only to teach students but is being spread to the local community for use in action programs and local education.

In summary, the problems with the program were all technical rather than substantive. The professors chosen did not all have prior experience with games; indeed most had never used a model. They came from a variety of disciplines and faced graduate and undergraduate students, in small as well as large numbers.

In the sections to follow are their own reports, unedited, although they were all asked to follow a similar format. In spite of the fact that the professors all started with the same introductory City and were asked to loosely follow a single format, the individualism which grew out of the study is most striking. This finding, like the others, is highly pleasing and helps to attest to the success of the idea of a single laboratory, which obviously can be used by different professors without placing them in a situation of artificial constraint.

The reports range in emphasis from how the professor used the laboratory, to additions which students made, and finally, to the validity and usefulness of the tool. Again, these reports stressed the richness of this technique.

CHAPTER VI

BLUE CITY ON A GREEN LANDSCAPE: A GAMING-SIMULATION AT DARTMOUTH

A Report to Envirometrics, Inc.
Washington, D. C.

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BLUE CITY ON A GREEN LANDSCAPE
A GAMING-SIMULATION AT DARTMOUTH

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PART I

INTRODUCTION:

During the past five years there have been few teaching members of Academia who have discovered themselves to be immune to the urgent press for new, exciting, teaching innovations. This past demi-decade has thrust an entertainment-jaded student generation into the university classroom where many of them believe they have paid to be amused,as well as educated. The response of the teacher to this set of expectations has fallen somewhere between a national tragedy and a national scandal: that is, many university faculty have sought "relevance" through "podium rhetoric" or the studied adoption of the stuttering phrases of the youth culture, rather than through presentation of their philosophical justifications for the kinds of knowledge they purvey. The extensive "knowledge-shaming" and "instant-erudition" that infuses so many campuses today is unfortunate, and dangerous to the reputation of Academia as a haven for unfettered learning.

In recognition of the problem of exciting this generation of students with the quest for knowledge, and doing this without sacrificing some heavily paid-for scholarly traditions, I sought to introduce some changes in the Urban Studies and City Planning Program at Dartmouth College (Appendix I). As the new head of the Program in 1969 I had been made aware of the CITY I gaming-simulation developed by the individuals who later founded ENVIROMETRICS INC. I then participated in a round of CITY I in Washington and decided that the gaming-simulation had enormous merit as an effective teaching device. For us at Dartmouth, the prospect of utilizing a gaming-simulation model to complement our urban field programs (in Boston and Montreal) seemed ideal. From this initial contact my participation in the project unfolded. I had no previous experience with modeling.

Our Urban Studies Program has more than one-hundred "concentrators" (they major in a discipline) but we have the capability of placing only about fifteen a year into an actual city environment. Some students chafed at the difficulty of "doing urban studies" in a rural area and raised some valid objections to our normal curriculum. Most of the students (largely majors in geography, political science, or sociology) take at least six courses from our program, but among these we had few offerings other than the survey and seminar type. The CITY MODEL offered us some new, valuable opportunities, and we seized them. This was done by inserting the gaming-simulation into our regular curriculum.

This report describes the experience we have had with the BLUE CITY sequence of the CITY II model during this academic year 1970-1971, where I employed the gaming-simulation in two distinct courses. Part II of this report describes the courses in which it was employed, including their structures and educational goals. Part III presents some tenative analysis of the dynamics of our play during both courses, and Part IV hazards some conclusions about the use of the CITY MODEL in undergraduate education from our experience at Dartmouth College. An extensive set of appendices accompany this text.

PART II

Course Descriptions

Modest flexibility in our curriculum and course content allowed us to employ the CITY MODEL immediately in two courses, however some serious constraints were introduced by our short term (10 weeks), the schedule of class hours which are difficult to rupture, and the responsibility to cover certain materials in our courses which are not within the context of the CITY MODEL. These constraints, as well as the manifold possibilities, operated differently in the two courses in which the model was employed.

This portion of the report treats with Geography 10, The City of The Future (a freshman seminar, during the Fall), and Geography 52, Urban Geography (an advanced lecture course during the Spring). Students from two other courses, as well as some non-course individuals took part in the gaming simulations: during the Geography 10 rounds sixteen of Professor Frank Smallwood's students from Government 31, Urban Government and Politics, took part in the play. During the Winter two experimental rounds were run (and later regretted) with Geography 42, a course in theoretical geography.

Geography 10 (See Appendix 2 for course outline).

This freshman seminar was the first I had taught and also the first college course for the sixteen men in the class. The aim of the course was to introduce these students to a seminar style of schooling as well as to the general content of urban studies. A disciplined structure was played down rather than emphasized. Some provocative readings were selected for discussion and the City Model was employed to help students act out ideas they were beginning to acquire, or had previously acquired about the city.

The course met twice a week for two hours, thereby allowing us the minimum time needed to complete a play of the model. In fact, I bargained with the students to have all of our other classes last 100 minutes if they would set aside 200 minutes whenever we ran the model. Generally, this time trade-off was successful with the freshman, but it was somewhat less successful with the students from Government 31 who were, in effect, being excused from three, ten page book review assignments for this participation in the model. A few of these students believed the time trade-off was weighted against them despite their interest in the gaming-simulation.

The model was run six times during the term, or roughly every fourth class period. This allowed for about ten days between runs, which was good from the point of view of physical turn-around time from Envirometrics, but it was judged poor by the students, whose interest flagged while waiting for the return of the computer output. Two formal discussions of the model were scheduled during the term, not including the introduction of the model but these discussions focused more on the dynamics of the play than on the driving mechanisms of the Model. The fact that these mechanisms were not wholly accessable to us was not important during the Fall when we even failed to make full use of the information provided in the City Manual, but during the Spring this circumstance became more of a problem with the advanced students who wanted to test some hypotheses.

Students were told at the beginning of the term that their participation in the Model would count for one-quarter of their final grade. This proved to be a greatly subjective element of the grading process because it was difficult to follow what each person was doing to arrive at his interactions and decisions. This was not troubling intellectually but it did raise a question about mixing the nature of the course - particularly for the larger Geography 52 course in the Spring Term.

Geography 52 (See Appendix 3 for Course outline)

Urban Geography is a lecture course which accomodates 40-50 students. Because it is a "core curriculum" course in our Urban Studies Program almost all of the students have had at least one urban studies course before taking Geography 52. Unfortunately, only about half of the students have had a course in geography. These circumstances sometimes make for a slow "lift-off" for the course because "in-filling" is required for the non-geographers.

The course meets three times a week 9:05 a.m. to 10:20 a.m. but again I was successful in trading-off the Saturday meeting of the class for a Tuesday evening meeting from 6:30 - 8:00 in order to run the model; in fact we never finished a Tuesday session before 9:30 p.m., a situation that created some problems in the latter part of the term.

I have given this course a half-dozen times and the aims of the course have been to introduce urban studies students to the spatial aspects of urban phenomena, and to provide geography students an intellectual arena in which to test ideas of the spatial organization of human activities.

There is some responsibility to cover certain materials in the course for the sake of both the Urban Studies Program, and the Geography Department, therefore there is less room for experimentation than in a Freshman Seminar.

Required readings for the course were not extensive, but each student was provided with supplementary reading lists and asked to consult them regularly (See Appendix 4 for reading lists). Both the required and suggested readings were designed to support discrete lectures and general topics respectively. There was no assigned reading on games, simulation, or modeling, although some of the students sought references on these subjects by the end of the term, even to the point of creating some of their term projects along gaming lines. (See Appendix 5 for list of student projects dealing with games, simulations and modeling). The readings, then, were not specifically designed to support the use of the CITY MODEL, but it was believed that ideas from the reading would come into play if they were perceived as useful.

THE CITY MODEL was used as a supportive, "imploding" element in the Geography 52 course. My participation in the Model was greater during these rounds than those run during the Fall, but in general I remained in the role as a technical assistant, organizer, and manager. This was planned, but it would have been forced on me anyway simply by the pressure of handling the details of the Model.

Our scheduled discussions about the CITY MODEL during the Spring were more analytical and comparative than those in the Fall for the obvious reason of experience with the model as well as a more advanced group of students. These discussions were often speculative with respect to the nature of the model but frustrating because we knew that the model would remain an "opaque substance" until we could truly subject it to experiments.

Grading participation in the Model was no less easy for Geography 52 than for Geography 10, especially since three of the forty-one students could not meet at the newly scheduled hour, but this situation was solved, in part, by introducing a new, and very exciting gaming-examination called, THE MUNIFICENT HEXAGON (See Appendix 6 for the Introduction and Rules). Along with employment of the Model itself this examination provoked more favorable reaction among students than anything I have experienced during my teaching career.

Summary:

The City Model was employed as an integral part of two distinct courses during the academic year 1970/1971. No course could be specifically designed to focus solely on the Model. Insecurity over my own abilities to direct a full model-based course, and insecurity introduced by having to rely on an outside source (ENVIROMETRICS) for the conduct of the course were too great to allow for unrestrained investment. It is my conclusion from considering the course structures of both Geography 10 and Geography 52 (in light of the goals of these courses, within the context of the Geography Department, and Urban Studies Program,) that a new course needs to be designed to employ fully the potentialities of the City Model, and other urban gaming-simulations. Such a course was designed for our summer school 1971 and successfully operated. It is hoped that this success will carry over into our regular curriculum on an experimental basis during 1971/1972, and regularly after that. Part III that follows examines the dynamics of the use of the Blue City sequence at Dartmouth, and although there will be many points of comparison between Geography 10 and Geography 52 rounds, much of the commentary is melded observation.

PART III

THE DYNAMICS OF THE MODEL'S USE: INTRODUCTION AND TRENDS

INTRODUCTION:

The introduction of the City Model is undoubtedly the most difficult aspect of its use because this is the point of ultimate ignorance of the players, most of whom have not gamed before. There is a real tension between the need to introduce the model, despite its massive and complex characteristics, and the need to allow play to proceed without the gamemaster introducing his own biases into the group of players. It is significant that players and professor alike perceived this to be the crucial point of the model's use and strived together to make it more readily understandable to later players by creating a videotape introduction (See Appendix 7). It is worthwhile discussing some aspects of the introduction of the model before proceeding to an analysis of play.

It is obvious that the gaming experience of most college students is limited, so the starting point for this kind of education is assumed to be zero. Unfortunately, after reading the City Manual (version of

August, 1970) the student's knowledge about the model, gaming, and his role in the gaming-simulation, did not increase greatly. Two reasons account for this: first, that version of the manual was not very clear and the errata were numerous; second, it was difficult for the student to believe that he was required "to learn" the Manual for the purpose of a game. Specifically, that version of the Manual desperately needed cross-referencing to speed up the student's ability to find out what he needed in discrete situations. In a few cases where errata existed (and were soon thereafter corrected by Envirometrics, Inc.) the most serious players became confused. Probably as important a factor was the failure of many players to familiarize themselves fully with the Manual before convening for the first play. They did their homework later, after they discovered the gaming-simulation to be a serious matter.

It was very important to employ the scenario walk-throughs provided by Envirometrics prior to our first run; now the more recently developed "Thumbnails" may give added support for the initiates. There was a great deal of fumbling in the beginning of play and some guidance and suggestion was necessary simply to inform players of what they could do.

A serious question must be raised about the "inflection state" of the model because it was discovered that the original board layout and the brief scenario provided go a long way toward determing later play and later configurations. For this reason I believe that the gamemaster should be especially careful when deriving a scenario, in order not to predicate the play. Normally the raison d'etre of the original scenario is expunged by the end of three rounds of play but there are certainly locational decisions and human interactions produced by the original scenario that linger much longer. It was discovered too that in a simulated decade of play the land use did not shift markedly, so one can assert that the original board layout had much to do with later play. This phenomenon of conservation, or pattern maintenance, was generally unruptured until "end-game phenomena" took over and players became more speculative.

The actual preparation for play at Dartmouth involved the following steps: a) an introductory lecture on the game, preceded by a reading assignment, b) display of materials, c) assigning of teams and roles. The introductory lecture involved a discussion of gaming, a description of the three sectors and their output, and a demonstration of interrelatedness in the model, using the processes of migration, employment and commerce as examples. It was explained to the players that the gamemaster could not possibly answer all of their questions and that it was incumbent upon them to work out most of their problems alone Most of the students had read the manual (but not carefully), before the lecture and many elementary questions were asked at this session.

Following the lecture the class was made to walk around the game room (which later acquired the name, URBAN/REGION SIMULATION LABORATORY), to examine the "public information" from the first round of the game, stopping at each set of data sheets (e.g. Personal Goods materials) and discussing some kinds of interactions that were revealed in the data. This excerise never was as successful as I had hoped it would be because the players seemed to ignore much of the data that were provided them, yet persisted in asking questions for which data were available.

Teams were then assigned, largely on the basis of preference. In some cases a flip of a coin was used to assign persons whose preferences were in conflict. During the Fall Term I put an older student with a younger student, and during the Spring Term I put experienced players with inexperienced players irrespective of age or class. This strategy worked well, as evidenced by the close cooperation and friendship that developed among players. In all cases players were assured that sometime they would play a different role. This assurance was not possible to honor in all cases but a real attempt was made without any feelings being ruffled.

It was extraordinarily fortunate that we had the use of a set of rooms, particularly one large game room, for the duration of the model's use. Two walls of our main room were cork board and one was chalk board, thereby facilitating information flow. The game information could be left on the walls during the inter-play periods and the team data sheets could be kept nearby for ready consultation. A 75" x 75" game board was mounted on one wall and it proved to be the focus of attention in much of the play. This board, and another developed by one of the students (shown in the videotape), were used for large scale planning by each sector. During the second set of runs a new position was created -- that of Boardmaster, whose main job was to provide immediate and accurate representation of changes in the configuration of the patterns displayed on the board. This player also did a landuse summary at the end of play.

Aside from the large room with movable tables and chairs, three other rooms were available most of the time and these proved useful for private meetings of the different sectors, indeed, during the second set of runs each sector was assigned a different room. One central room had two teletype terminals tied into our computer system; these were used by players to leave messages for one another after we developed a safeguarded Message Center system.

Such were the conditions of introduction to the play and to the physical surroundings of the gaming area. Considering the lack of a true gaming center we did well to find and use these kinds of facilities which aided the introduction of the Model, as well as they facilitated play. The need for better introductory procedures was still felt early in the second set of plays, and a group of six students took on a special project of developing a videotape introduction to the model. The tape developed was technically sound and highly informative. The tape was played for more than 120 delegates who came from all over the United States to attend a Conference on Computers in Undergraduate Curricula, held at Dartmouth during late June. The tape was accompanied by a talk on urban gaming models, especially the City Model. The tape and talk were warmly received and should generate many inquiries to Envirometrics. The tape was also used to introduce a Summer School class to the model, and although it seemed to help launch the play it is too soon to assess the results.

Trend of Play:

The trend of play differed radically from the Fall run of the model to the Spring run; the difference may be characterized as a shift from idealism to realism, from cooperation to competition, from "getting it together", to just plain "getting it". Certainly there are many reasons for this shift but I have been able to identify only three with surety. One, the model, with its pre-digested scenario became the object toward which competition was directed and students pulled together to beat the "given" system. Two, an unusually charismatic student leader was the Fall term chairman, and he chose to try to pull all elements of the city together. Three, during the Spring term we began play with the three sectors in different rooms rather than together (as was done during the Fall), and the result was heightened suspicion between sectors. In addition, by Spring Term the experienced players gravitated toward the roles of the economic sector, leaving the social sector relatively poorly staffed.

Due to some special circumstances of play the evaluation that follows is comparative, that is, over the period of four rounds the play from the Fall Term and the Spring Term were parallel rather than sequential. Due to a lost tape at the beginning of the Spring Term it was necessary to play rounds 4 through 7 over again. At first this was perceived as a problem but later it was considered an asset because it afforded the possibility of reasonable comparison of play in a way that might not otherwise have been achieved. The economic and the government sectors are formally compared here but the social sector activities are better treated in a non-formal sense because the most interesting activities of the social sector were outside the model.

Economic Sector:*

Through these two comparable runs, one can discern the differences and similarities in behavior of economic sector players for each run and the underlying constant factors involved in the CITY game itself. Blue City, in all respects, is a small urban area, even as of Round 7: there is only one construction company, one business goods establishment and one business services outlet. There are only two developments of each type of national industry. Even in the two personal services businesses and three personal goods outlets, these industries were plagued with recurrent overcapacity problems in the face of slack social sector demand. The housing shortage also contributed to producing a demand for personal goods and personal services that was less than it could have been. Blue City would probably have been just as well off with smaller and healthier PS and PG.

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* Much of the economic sector evaluation was prepared by two student assistants. Bill Price and Richard Schwager.

Data collection was accomplished by separating each firm into its individual business establishment components. A complicating factor was the floating of a negative 6 billion dollar loan from E to B during the Fall 1970 Round 7. Unscrambling the resulting maze of interest payments and debt payments for each firm was quite difficult. The data was then summed on two bases - firm-wide and industry wide, giving, for example, summed results for Economic A and also for all RA. The data collected was chosen in an attempt to measure growth and profitablility. For an individual business, these two factors were respectively measured by total sales/rent and net income data. For an industry of businesses, these were summed for all of a particular business over all firms. For a firm of businesses, growth and profitability were measured respectively by net worth and cash balance. The resulting data was used to calculate percentage changes to facilitate the detection of trends. The basic data was also used to compute a measure of liquidity, (total cash balance ÷ net worth). This was used to indicate the extent of ready funds on hand, an indicator of growth potential for Blue City each round. Growth, profitability, liquidity were finally compared with population by calculation of correlation coefficients between the various measures, indicating how closely related some of the phenomena were in the underlying model, and perhaps in an actual city.

A) Data & Graphs

The actual data accumulation involved a sector-by-sector account of economic decision-makers A,B,C,E,F,G, (D is missing due to the absence of Old Round data.) An account was made of the sales and net income of these 6 sectors for rounds 4 through 7 of both the original fall '70 runs (by Geography 10 and Government 31 students) and the most recent spring'71 runs (by Geography 52 students). This is data included as Appendix 8, (in which all values omit a (000) place.)

An unscientific grasp of the economic progress of Blue City over these four rounds can be obtained from this data. The "flow" or total economy shows a steady rise in "net income", or the value for "net worth". Among the steady improvers over time seem to be the 30 RA units, the 10 RB units, and the 6 RC units, thus increasing gains from residential ownership. The business and industrial operations tend to be more sporadic in their earnings, reflecting their crucial necessity of frequently varying sales, susceptibility to utility-tax-extra costs changes, over-capacity, and dependence upon the mercurial social sector activities.

These four factors are intuitively observed in those firms which had sporadic gains - the one BG unit, the one CI firm, and the two HI industries. They can also be seen in those which had slowly increasing sales and incomes, were the two LI and two NS establishments; and especially in those which suffered enough to lose money regularly - the one BS firm, the two pathetic PS units, and the three PG firms. To single out a few glaring examples,...

CI: the CI firm's sporadic gains resulted from a periodocity of demand and occasional utilization of the outside system for construction.

PS & PG: These units combined $108 million deficit for New round 7 (vs.-$51 million for old) come from a distinct over-capacity, that is an ingrained underdemand for Blue City's needs, and harsh treatment by the Social Sector on whom they rely completely.

Other results derive from this data and the graphs drawn for sectors E,F,G, included as "Appendix 9". The Old round data and graphed income lines show a greater increase than the New round data, narrowly but visibly. Despite the fact that the two Rounds 4 were supposedly generated equally, small discrepancies due to the random generators, and delayed decisions created slightly different Round 4 base data. However, this result is clear in the following comparison of the higher values or ties between the two runs at two different periods.

Round 4			Round 7		
Old	New	Ties	Old	New	Ties
16	12	5	21	10	2

A visual check shows a greater improvement for the Old run between rounds, a suspicion confirmed later by more careful analysis.

B) Charts & Correlations

(1) Venturing into this more precise analysis, it was necessary to invent some parameters to check the two Rounds' results over time. Three parameters were devised:

Profitability as: (net income) ÷ (sales)

Growth as: percent changes of values over time

Liquidity as: (cash balance) ÷ (net worth)

Using these parameters, included as Appendix 10, clear changes and advances become noticeable.

In profitability, the ratios ranged from -.454 to +.357; advances and declines mirror earlier guesses. Oddly enough, the highest profits came for RA, RB, RC for both Rounds' values; the unprofitable units were for PS, PG, and BS (Old only), an indication of their ponderous natures. Low return units were the HI, LI, NS, and CI - about .1 to .2 for profitability. Comparing the Rounds' totals, 11 declines occurred for the Old, to 9 for the New; so to compare,

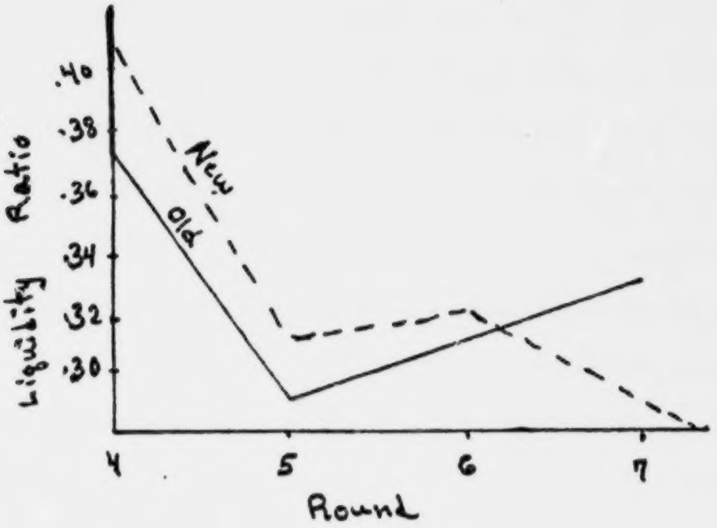
Round 4		Round 7		
Old	New	Old	New	
5	6	6	5	higher profit ratios

Thus, the two Rounds show generally equal profitability.

In growth, different results fall out of the data. The net worth change, cash balance change, and Blue City population change were analyzed for round-to-round growth. Over the three rounds, the relative growth of Old population was greater than the growth of net worth, while the net worth in the New rounds was relatively greater than the growth of population. For the Old runs, because the growth of net worth was relatively less than the population growth, production failed to keep pace with the population by 28 1/2% to 32%; conversely, for the New runs production exceeded population narrowly, 33 1/2% to 33%. But the interesting growth pattern belongs to the cash balance change, important because it represents the firm's capacity to expand, improve, or build (i.e., if you have a negative cash balance, no money-requiring venture can be achieved, and economic decline is signalled). Both Rounds/Runs showed weighty declines from round 4 to 5, but Old runs' rallied to salvage an overall 13% increase; New runs were plagued with failings in the PS + PG units, which yielded an overall - 5 2/3% growth, or a net decline in cash balance. This single fact conveys the relative unproductivity in the New runs, and a cause for malaise in Blue City for spring '71.

In liquidity, the 3rd parameter, the resulting ratios represent the amount of funds in the net worth available for future expansion or investment. The values roughly parallel the growth and cash balance findings, such that the New runs failed to reverse the progressive decrease in liquidity over time. Both Runs' fell from round 4 highs of .374 and

and .411 to a low at round 5, but Old grew as New fell further to .29. This "progressivity" is illustrated below.



Despite the short period for examination, this drop in New's liquidity, added to its troubles with cash balances, give the nod for general economic health to the Old runs' productive capacity.

(C) To augment these results, and to help clarify the confusing array of previous findings, it was necessary to try some correlation coefficients. These coefficients range from -1 to +1, with -1 representing perfect negative correlation (movement in opposite directions) and +1 representing perfect positive correlation (movement in same directions and at same degree). The results are included in the Appendix 11.

The correlations of the three parameters previously discussed. The profitability correlations for the Old vs. New Runs of rounds 4-7 revealed high correlations for: the 3 residences, the NS, LI, BS, the PG and CI firms; low correlations for: the HI and BG and PS firms. These results follow from earlier thoughts, representing similar management (i.e. decision-makers') decisions for those eight high' firms, or steady rates of increase; the 'low' firms' came from industry's sporadic movement (HI and BG) plus the Social Sectors' actions (PS). In general, the 6 firms' coefficients were greater than +.9, thereby displaying a remarkable similarity in decision-making operations with respect to profitability.

The growth correlations reveal much more on Blue City's progression through the twin sets of rounds. "Net worth's" +.425 value stems from New's upturn from round 6-7 when Old hit a downturn, "Cash balance's" high +.907 stems from a similar movement in values (despite Old's consistantly higher values); "Population's" near-perfect +.99 is to be expected if the twin Runs were equal, because population increased similarly for both Runs. The "liquidity correlations" substantiate the earlier finding that the differing Runs possessed similar decreases in liquidity through round 6 (the +.99 result), but had a divergence in round 7 (thus the +.80 result).

The cross correlations represent an attempt to analyze general trends. It is with these that interesting coefficients appear. The extremely high old "net worth" to Old "population" correlation of +.998 represents a remarkable similarity in movement and growth, while the New value of +.234 shows the dissimilar trends articulated earlier. The high negative value of -.952 for New "net worth" to New "cash balance" further shows the negative trend of the cash balance movement, while the -.53 for Old shows a mediocre relation in opposite ways. In total, these figures lead to several conclusions.

D) Conclusions

(1) a relative increase in the Old run liquidity and growth in cash balance points to its superior advantage in investment, building, and growth over the New run.

(2) high profitability correlations for almost every branch of the economy point to a general similarity of decisions and cognizance of the play of Blue City.

(3) over all 4 rounds then, the Old runs enjoyed a better advantage for growth but both Runs exhibited similar decision-results, with the New runs exhibiting difficulties in its PS & PG units being the major difference; thus the New fared well with what it had, and despite a negative growth in its cash balance (which, of course restricted activity.)

Government Sector:

It was agreed by almost all of the government players who had experienced roles in other sectors that the Government sector was the most demanding of their time and energy: more people to deal with (often aggregated at the end of the game period), more general responsibility in decision-making that was taken seriously, constant pressure to balance diverse interests and to project a leadership image of its own all contributed to the difficulty of play. Although this sector has the potential to be the most unstable of the three in terms of personnel it proved to be remarkably stable. In fact, once a player learned the mechanics and mores of a government role he was reluctant to relinquish it, even when the Chairman changed. Moreover, the electorate and the new Chairman were always anxious to retain most of the non-elected government officials from the previous regime. All of this suggests that politics was relatively less important to the players than technocratic management, and this attitude induced a great deal of conservancy in the play. In fact, over a cumulative total of fifteen rounds of play the government changed hands only twice, and it is doubtful that it would have changed a single time without artificial outside pressure from the game director. In the elective process there was almost no trading of votes for specific policies, and, in general there was very little interest in politics. At some elections the incumbent had to be reminded to file for re-election, and in a half-dozen cases he ran unopposed and was elected unanimously.

Neither the Social Sector nor the Economic Sector put much pressure on the Government, but on the whole the Government was more responsive to the requests of the Economic Sector. There was virtually no bribery in the play. The Social Sector players were generally too lost and disorganized to pressure either sector.

In a brief student analysis of selected departments of the government where the student compared the Fall and Spring terms of play he discovered that aside from their obvious correlations with population, the rates of growth of demand for both Utilities and Municipal Services are both greater and steadier in the new play than in the old.* The graphs (Figures 1 & 2) show these rates of growth and compare them to population growth.

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* The analysis was carried out by William White.

Figure 3 shows the tax structure in Blue City. It does not include such things as bus fares, utility billing, and bribes, which cannot be counted as part of the total picture. In both graphs, the Resident Income Tax and Property Improvement Tax share a little over 75% of the load. The general structure is, in itself, no cause for discontent, and thus has remained stable through the life of the model.

Figure 4 is perhaps the most interesting of all, for it provides some insight into the inner workings and intricacies of the model. A high use-index in the school system implies that the quality of public schooling is somewhat low. Therefore it is logical that the parents of the children will put them where the quality of education is best. In the case of a high use-index, the number of children in public school will be lower. The printout numbers have been translated into percentages, where the number of children in public school is a percentage of the total number of school-age children. When the school system's use-index is high, a smaller percentage of children attend public school. The actual correlation is about -0.9.

The fluctuations of use-index in the old play and its relative calmness in the new play is directly attributable, again, to the longevity of the "superintendents of schools." A short period of "breaking in" is necessary, as shown by the new play, where conditions have been improving steadily since Round Five.

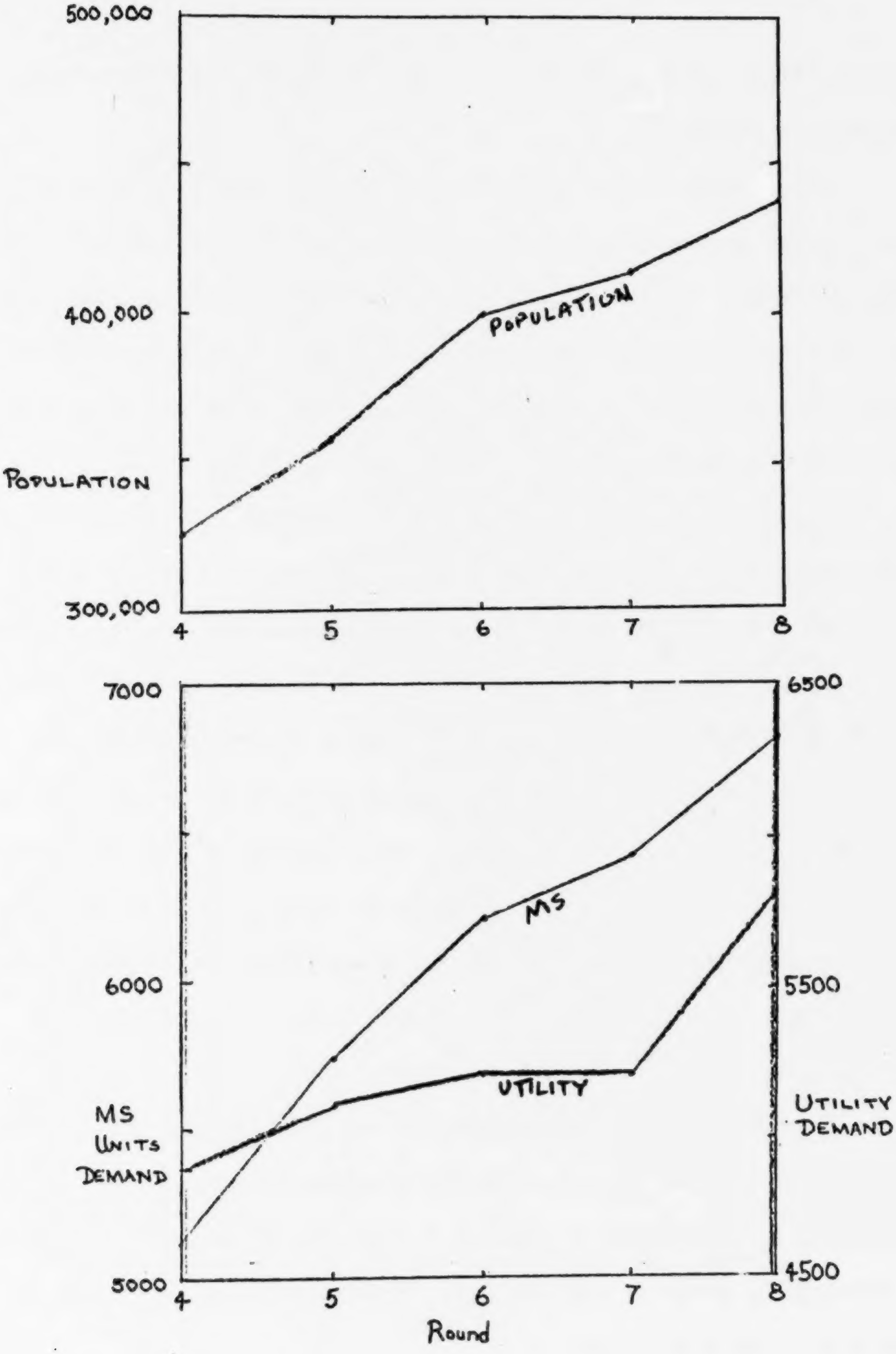

500,000
400,000
300,000
Population
Population
4
5
6
7
8
7000
6000
5000
MS Units Demand
MS
Utility
6500
5500
4500
Utility Demand
4
5
6
7
8
Round

FIGURE ONE

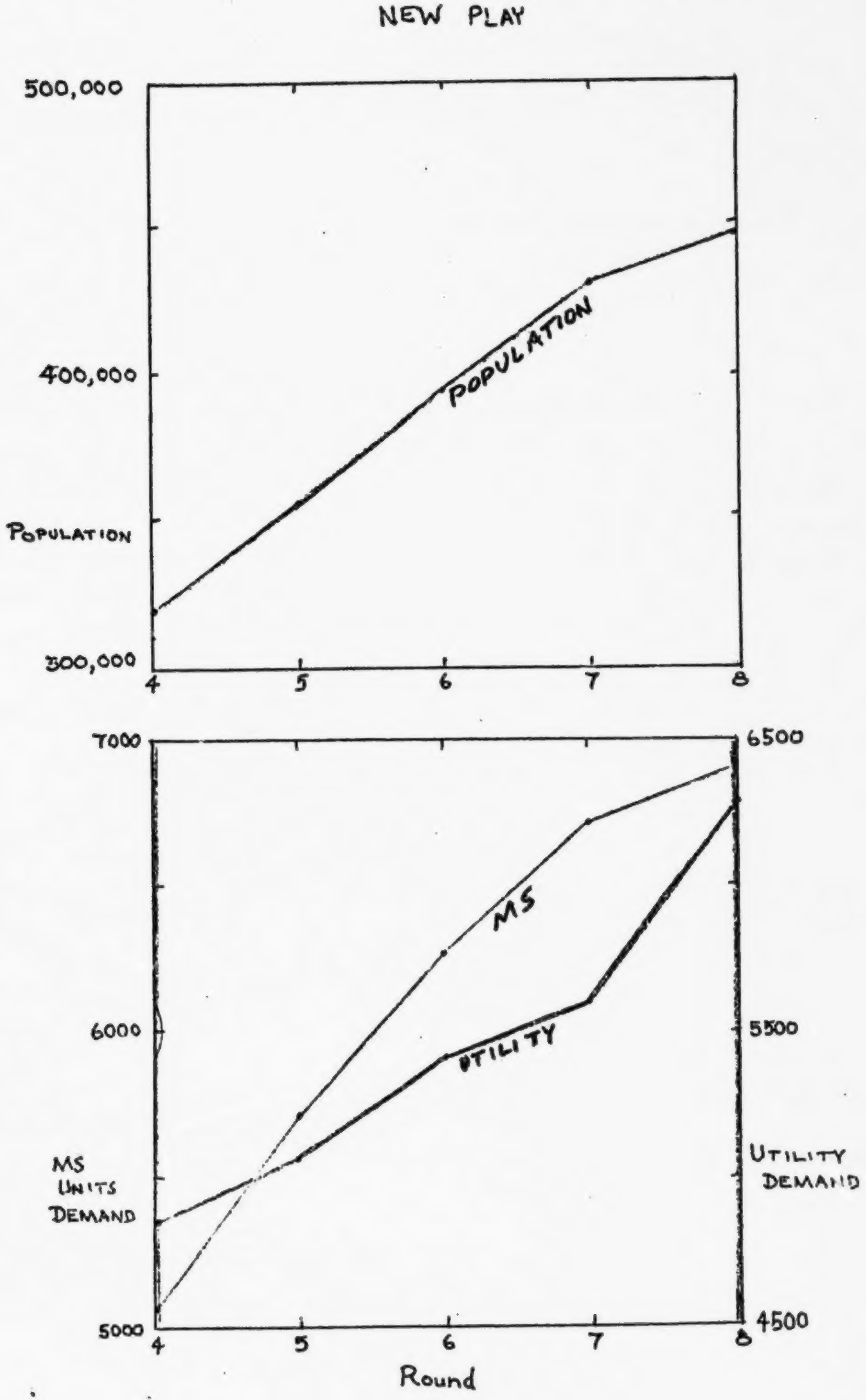

NEW PLAY
500,000
400,000
Population
300,000
POPULATION
4
5
6
7
8
7000
6000
5000
6500
5500
4500
MS
UTILITY
MS
Units
Demand
Utility
Demand
4
5
6
7
8
Round

FIGURE TWO

TAX REVENUES

A COMPARISON

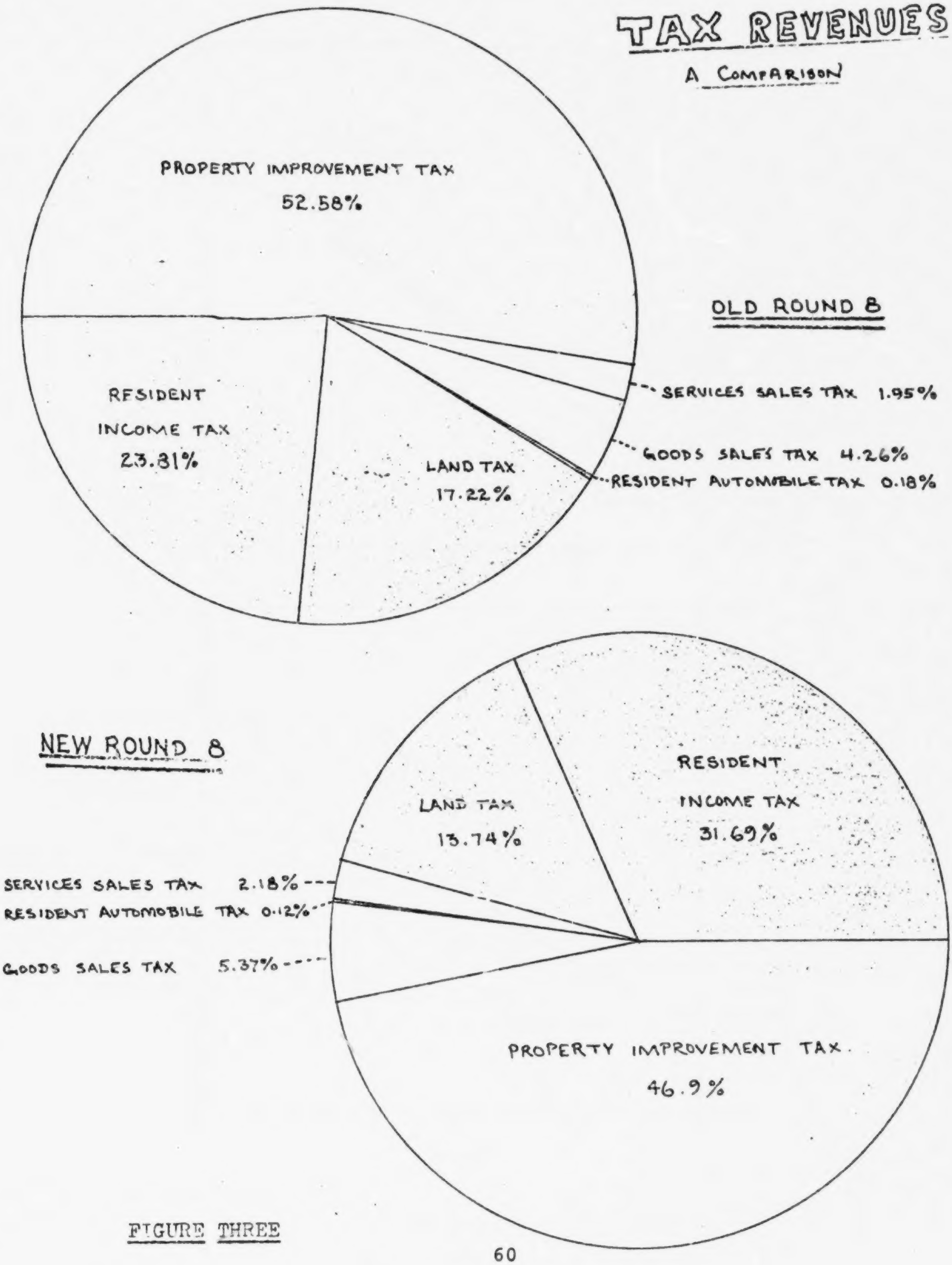


FIGURE THREE

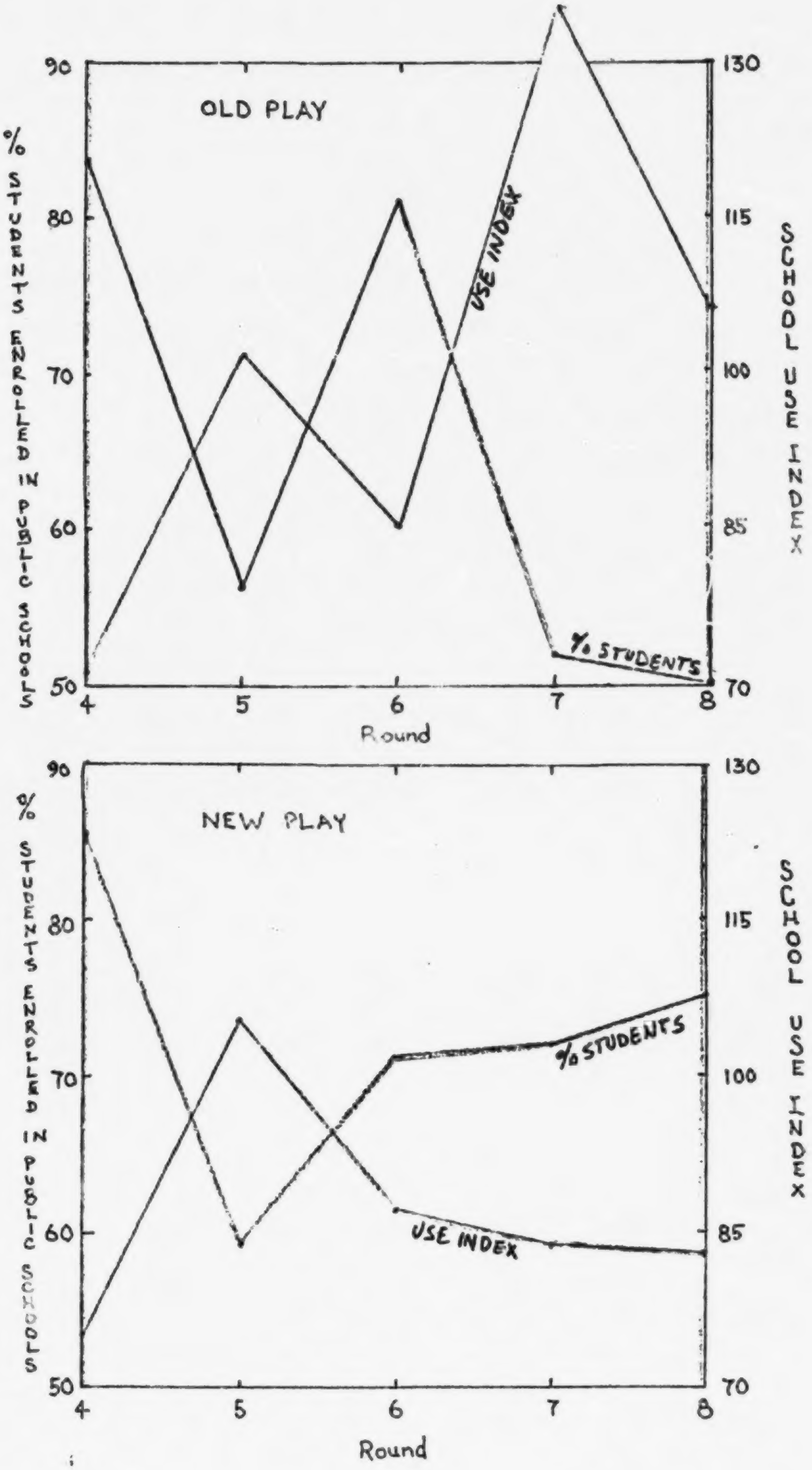

OLD PLAY
% STUDENTS ENROLLED IN PUBLIC SCHOOLS
90
80
70
60
50
SCHOOL USE INDEX
130
115
100
85
70
USE INDEX
% STUDENTS
4
5
6
7
8
Round
NEW PLAY
% STUDENTS ENROLLED IN PUBLIC SCHOOLS
90
80
70
60
50
SCHOOL USE INDEX
130
115
100
85
70
% STUDENTS
USE INDEX
4
5
6
7
8
Round

FIGURE FOUR

In a department by department break down for "services" for the two runs it is possible to compare the differential development of the two plays.

	Rounds							
	4		5		6		7	
Highway	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Road Mantenance ($ Millions)	.987	1.09	1.11	1.19	1.62	1.52	1.66	1.73
Average Depletion before Maintenance								
Road Type								
1	1.7	1.3	2.0	1.4	2.4	1.8	2.1	1.8
2	1.4	1.4	1.3	1.6	1.4	1.2	1.2	1.2
3	0.9	1.1	1.0	1.1	1.5	1.7	1.6	1.7
School								
Hi Use Index	91	91	200	200(?)	91	94	92	99
Lo Use Index	62	64	68	71	73	72	64	74
% Private Ed.	.164	.129	.440	.409	.234	.287	.161	.280
Unmet Adult Education Demand	2795	2775	4705	4835	705	0	0	1317
Municipal Services								
Hi MS Index	121	109	101	101	128	127	128	200
Lo MS Index	64	59	89	89	90	96	93	200
Welfare Payment $	1200	1200	1200	1200	1200	1200	1200	1200
Total Welfare $	0	0	0	0	0	0	0	0
Utilities								
Hi Cost/Unit Plant	8249	7323	7589	7357	7456	7433	7998	7568
Lo Cost/Unit Plant	7559	7197	7354	6762	6736	7399	7048	7503
Charge ($1000)	10.2	9.7	10.2	9.7	10.2	9.7	10.2	9.7

One may conclude from a cursory examination of the data that over the comparable four rounds there was considerable similarity in the data for government "services" of Highways, Schools, Municipal Services and Utilities. No trend emerges that cannot be explained from population increase in the Model. This suggests that the continuity of government decision making from the Fall term to the Spring term was maintained, or that the Model is not very sensitive to the decisions from this sector.

General Trends of Play:

Observations of the extended play that was carried out by the Dartmouth group allows the following categorization of the trend of play:

Characteristic	Rounds
Confusion	1 and 2
Competence	3 and 4
Complacency	4 and 5
Cognition	6 and beyond

As noted above, there was general confusion for two rounds of play as the participants frantically explored the Model. This period was characterized by great frustration at the seemingly overwhelming amount of information to process and interactions to strive for. Students often pleaded for guidance and help and became angry if satisfactory advice was not forthcoming.

This period of confusion was followed by a period of relative competence in the game techniques and relative stability of play. Questions to the Director dropped off sharply and some innovations and unusual combinations began to be formulated by a few players. This situation lasted for two rounds of play and was followed by one or two rounds of bored complacency. During this period the economic sector made money, the social sector remained disorganized, and the government was not pressed from any side. There was a definite threat around rounds 4 and 5 that students would lose interest in play if no external pressures were introduced. In the Fall the social sector did induce a crisis by threat of boycotts and physical damage, but even here this suggestion came from a non-player. In the Spring Term the Director induced a crisis by asking the Envirometrics Staff for an increase in the dissatisfaction index and for an economic depression. The social crisis did occur but the economic crisis did not. It was the general lack of economic shortage in the model relative to the perception of possibilities by the students that contributed to complacency. Some students did not grow in their sophistication beyond the complacent stage although most of them tried to mask their lack of interest. Other students, more than half of the players, became cognizant of a wider arena for action, a greater number of possibilities, and a deeper meaning in the play of the game, all of which gave them a "second wind" that carried beyond the termination of play.

PART IV

CONCLUSIONS

Some of my conclusions are implicit in the foregoing remarks, however it is worthwhile to restate them explicity.

1. The experience of using the City Model has thoroughly convinced me that it is a superior learning device when used effectively:

a greater percentage of a class is intellectually engaged in the gaming-simulation than is engaged in normal curricular offerings. Obviously novelty has something to do with this but it goes deeper than that in the context of contemporary, conventional academic offerings.

II. The use of a complex model like Blue City requires the building of a course around it rather than leaving it on the periphery of a course. From a teaching standpoint I am no longer troubled by the prospect of making gaming-simulation the core technique in a course. I would not, however, risk the building of a regular curricular offering along these lines until I had secure access to the model on our own computer -- indeed such a course would probably not pass through the curriculum committee (a necessary procedure for regular offerings at Dartmouth and most other Universitites) without assurances of the Model's immediate availability.

III. The instructor should build the class up to the use of the City Model by using some simpler games so that the gaming concept becomes more clearly fixed in the student's mind before play begins. This should be part of a general orientation to the Model and should be punctuated with lectures and discussions.

IV. It is absolutely imperative that one or more assistants be engaged to help run the play and take care of the detailed work thereby allowing the teacher to be free to discuss ideas with the students.

V. To be fully effective as a teaching device the students should be able to experiment with the model in some controlled fashion so that it passes from the realm of an engaging teaching tool into a true social science laboratory.

VI. The physical environment of the gaming area is very important to play. Access to several rooms which do not conflict with other classes, and the flexibility of the rooms themselves are crucial. There should be effective display space to show the public information of the model. A large,up-to-date land use map is especially important.

VII. There must be a critical mass of players (which occurs at about twenty), to have effective play; my preference is for twice that number. There must also be an extended enough period of play (number of rounds) to allow for responsible actions to evolve. The final round should not be divulged ahead of time so that "end-game phenomena" may be avoided.

VIII. The more different kinds of people (age, race, education level) the more interesting and fruitful the learning experience of the play.

IX. Bugs in the model should be corrected as soon as possible because their peristence has a deleterious effect on the play.

X. The Manual should be re-evaluated and revised as ways to clarify instructions are discovered.

XI. Serious evaluation should be made of the influence of the starting conditions of the model on the end result of play. This seems to be an important area for social science research.

XII. Continued experimental play such as that carried out by the six universitites would be useful to those responsible for the development of the model - better still would be the release of the model to universities with the capability to experiment with it and to elaborate further its powerful teaching potential.

Appendix 2

GEOGRAPHY 10

THE CITY OF THE FUTURE

Professor John W. Sommer
306 McNutt Hall
Wednesday and Friday at 10:30 a.m.

The City of the Future

This seminar is designed to do several things: to inform you of contemporary urban life through the recent writings of some social scientists; to engage you in the actual simulation of an urban area through the use of the City Model; to sharpen your writing ability through the submission for criticism of several papers; to develop oral expression by presentation of reports; and, to have some fun while we do it. Although our approach to this subject must be eclectic there will be a noticeable emphasis on the spatial expression of urban dynamics - this is what the geographer brings to any discussion of the city.

Below are the text requirements. These will be supplemented by readings at the Reserve Desk at Baker Library.

E. Banfield	*The Unheavenly City*
H. Cox	*The Secular City*
Daedalus	*The Conscience of the City*
E. Hall	*The Hidden Dimension*
G. Suttles	*Social Order of the Slum*
Envirometrics	*The City Manual* (See Professor Sommer)

Office: 301 McNutt. Telephone 646-3117

Office Hours: To be established early in the term.

Schedule of Meetings: *

Friday, September 25	An Introduction to Urban Studies at Dartmouth and to the seminar.
Wednesday, September 30	Lecture: The Growth and Spread of Urbanization; An Introduction to The City Model. Read: *The City Manual*
Friday, October 2	Play I: Blue City at the first generation. Submission of data must be completed by 10:00 p.m. Read: *Blue City Scenario*
Wednesday, October 7	Lecture: Hedonopolis, Fat City and the Mobile Parasitopoli.
Thursday, October 8	Report due on E.K. Hall's, The Hidden Dimension.
Friday, October 9	Discussion: The Hidden Dimension; Questions of Perception of Environment Read: *E.K. Hall, The Hidden Dimension* *Saarinen. Perception of Environment.*
Wednesday, October 14	Play II: Blue City at the second generation. Data submission due by 6:00 p.m.
Friday, October 16	No Class
Tuesday, October 20	Review due on H. Cox's, The Secular City
Wednesday, October 21	Discussion: The Secular City: Questions of Human Response to Urban Life. Read: *H. Cox. The Secular City* *Rose. Social Processes in the City.*
Friday, October 23	College Holiday.

* This schedule may be further developed, especially in relation to the playing of Blue City.

Wednesday, October 28	Play III: Blue City at third generation. This session to be videotaped. Submission of data due at 5:00 p.m.
Friday, October 30	Discussion: Review of videotape and discussion on the progress of Blue City.
Wednesday, November 4	Discussion: The Conscience of the City. Each student will present a precis of a chapter in the Daedalus piece. Specific assignments will be made in class. Read: *Daedalus. The Conscience of The City.*
Friday, November 6	Discussion: Continuation of the presentations begun during the previous session.
Wednesday, November 11	Play IV: Fourth generation of Blue City.
Friday, November 13	Discussion: Social Order of a Slum. Questions of territoriality in urban space. Read: *G. Suttles. Social Order of The Slum.*
Wednesday, November 18	Discussion: The Unheavenly City: Is there an "urban problem?" Read: *E. Banfield. The Unheavenly City.*
Friday, November 20	Lecture: Urban Geography and Planning; Scholarship and Social Responsibility. Outline for a research paper on the city of the future is due.
Tuesday, November 24	Reflective essay on The Individual in an Urban Environment is due.
Wednesday, November 25	Play V: Final generation of Blue City.
Friday, November 27	College Holiday
Wednesday, December 2) Friday, December 4) Wednesday, December 9)	Discussion: Oral presentation of reflective essays on the Individual in an Urban Environment.
Friday, December 11	Research paper due. Final conference with the instructor to discuss the research paper will occur during the final examination period.

Appendix 3

URBAN GEOGRAPHY

Geography 52
Spring 1971
T & Th 9:15 a.m.
Tuesday 6:30-8:00

Professor John Sommer

This course is designed to introduce you to the study of urbanization with the tools of the geographer. One must realize that not all aspects of urban geography can be examined in one term so have limited the scope of the course, hopefully without sacrifice of any major portion of the field. Our intent is to review some theoretical notions during the first part of the course and to relate them to specific cases. During the second part of the course we shall engage in practical work in the field which will be analyzed and presented during the last two weeks of the term. One day each week will be devoted to the play of Blue City, an urban simulation game. These plays will run parallel to the lectures and reading but it is hoped that both aspects of the course will influence the other. Blue City must be run at a time other than the class period so I propose we utilize Tuesday 6:30 - 8:30 p.m.

In addition to the normal class period the instructor will be available as a resource person on selected X-Hours for student organized discussions or seminars. Please keep in mind that at least one weekend (probably the weekend of May 22 and 23) will be engaged for field research. *Do not plan to do anything but Geography 52 at that time*.

The reading for the course is ample without being too burdensome; it is, however, concentrated in the first six weeks of the term so do not let yourself get too far behind. There will be one three hour examination in mid May. This examination will count 50% of the final grade. The term project resulting from the field research will count 30%. A variety of other exercises, make up the remaining 20%; these include participation in, and critique Blue City, a set of five one or two page written precis of articles which support your field research, and the completion of several assigned exercises. You will be responsible for all assigned reading, whether covered in the lectures or not, and you will also be responsible for ideas developed in lecture and discussion sessions.

Office hours for Geography 52 for Mr. Sommer are: Mon. 1:30 - 3:00
Others to be set-up later.

TEXTS:
B.J.L. Berry. *The Geography of Market Centers and Retail Distribution*
G. Breese, *Urbanization in Newly Developing Countries*
G. Suttles, *The Social Order of the Slum*

Recommended:
B.J.L. Berry and F. Horton, *Geographic Perspectives on Urban Systems*
L.S. Bourne, *Internal Structures of The City: Readings on Space and Environment*

CLASS MEETINGS

April 1	Scale Components in Urban Geography
April 3	Historical Urbanization
April 5	Re-Discovering Iran's Most Ancient Civilization: Tepe Yahya 8:30 p.m. 28 Silsby Hall.
April 6	Tepe Yahya (Coffee in the Lounge after, 10:20)
April 6	Introduction to Blue City 6:30 p.m.
April 8	Urban Typologies: The Case of the Pre-Industrial City of Fez
April 9	X-HOUR Blue City Round 7 Decision Making 8:00 a.m.-9:30
April 13	Urbanization in Middle America in Antiquity
April 13	Blue City Discussion and Planning
April 15	Cities as Points: The Economic Base of Cities
April 20	Blue City Round 8 6:30 p.m. (No lecture scheduled)
April 22	Cities as Points: The Canadian Urban System
April 27	Cities as Areas: The Surface of London, Ontario
April 27	Blue City, Round 9 6:30 p.m.
April 29	Cities as Areas: Land Rent Curves and Core Deterioration: Tacoma
May 4	They Influence of Transportation on Spatial Change & Social Strees in the Capitalist City
May 4	Blue City, Round 10 6:30 p.m.
May 6	Cities as Volumes: Boston South End
May 11	Cities as Volumes: Black City: Patterns of Urban Demography in the United States
May 11	Blue City, Round 11
May 13	Wholesale and Retail Trade in New England
May 18	Blue City, Round 12

May 20	Hour Examination: 9:15-10:20
May 22-23-24	FIELD RESEARCH
May 25	Blue City, Round 13 6:30 p.m. (No Class scheduled)
May 27	Moscow: A City of Socialist Man
June 1	Blue City, Round 14 6:30 p.m. (No Class scheduled)
June 3	An Integrated View of Dakara Post-Colonial Capital

Appendix 4

GEOGRAPHY 52

BIBLIOGRAPHY: URBANIZATION

ANDERSON, Nels (ed.) Urbanism and Urbanization, (London: J.H.Brill, 1964).

BERRY, Brian J.L. "Some Relations of Urbanization and Basic Concepts of Economic Development", in Pitts (ed.) Urban Systems and Economic Development, (University of Oregon, 1962).

BERRY, Brian J.L. Metropolitan Area Definition: Re-Evaluation of Concept and Statistical Practice, Working Paper No. 28, (Washington: U.S. Bureau of the Census, 1968).

BERRY, Brian J.L. and NEILS, Elaine "The Urban Environment Went Large", Harvey S. Perloff (ed.) The Quality of the Urban Environment, (Washington: Resources for the Future, 1969).

BOGUE, Donald J. The Structure of the Metropolitan Community, (Ann Arbor: University of Michigan Press, 1949).

BORCHERT, John "American Metropolitan Evolution", Geographical Review, LVII, (July, 1967), pp. 301-32.

BORCHERT, John The Urbanization of the Upper Midwest 1930-60, Urban Report #2, (Minneapolis: UMES, 1963).

BREESE, G.E. Urbanization in Newly Developing Countries, (New York: Prentice-Hall, 1966).

BREESE, G.E. The City in Newly Developing Countries, (Englewood Cliffs: Prentice-Hall, 1969).

DAEDALUS, XCVII (Fall, 1968) "The Conscience of the City"; particularly article by Webber, Meier.

ELDRIDGE, Hope T. "The Process of Urbanization", in Spengler J.J. and Duncan, O.D. (eds.) Demographic Analysis.

FOX, Karl "The Functional Economic Area: Delineation and Implications for Economic Analysis and Policy", Papers and Proceedings of the Regional Science Association, XV, (1965), pp. 57-85.

FRIEDMANN, J. "Two Concepts of Urbanization, a Comment", Urban Affairs, Quarterly I, (June, 1964), pp. 78-84.

FRIEDMANN, J. "Cities in Social Transformation", Comparative Studies in Society and History, IV, (1961); reprinted in Friedmann and Alonso, pp. 343-60.

FRIEDMANN, J. and MILLER, J. "The Urban Field", Journal of the American Institute of Planners, XXX, (Nov., 1965), pp. 312-20.

GANS, Herbert The Urban Villagers, (New York: The Free Press of Glencoe, 1962).

GLAAB, Charles N. and A. Theodore Brown A History of Urban America, (New York: MacMillan, 1967).

GRAS, N.S.B. Introduction to Economic History, (New York: Harpers, 1922), Chapter IV, V and VI.

HANDLIN, Oscar and BURCHARD, John The Historian and the City, (Cambridge: MIT Press, 1963) particularly the article by Lampard, "Urbanization and Social Change".

HATT, Paul K. and REISS, Albert J. Jr., (eds) Cities and Society, (The York: Free Press of Glencoe, 1957) especially Horace Miner, "The Folk-Urban Continuum"; Otis D. Duncan, "Community Size and the Rural Urban Continuum"; National Resources Committee, "The Process of Urbanization".

HAUSER, P.M. and SCHNORE, L.F. (eds.) The Study of Urbanization, (New York: John Wiley, 1965) particularly the articles by
Hauser, "Urbanization: an Overview"
Sjoberg, "Cities in Developing and Industrial Societies: A Cross-cultural analysis"
Keyfitz, "Political-economic Aspects of Urbanization in South and Southeast Asia"
Thompson, "Urban Economic Growth and Development in a National System of Cities"
Lampard, "Historical Aspects of Urbanization".

HAWLEY, Amos H. The Changing Shape of Metropolitan America: Deconcentration Since 1920, (Glencoe, Ill.: The Free Press, 1956)

HOLZNER, Lutz "World Regions in Urban Geography", A.A.A.C., LVII, Dec. 1967, pp. 704-12.

HOYT, Homer World Urbanization, Technical Bulletin #43, Urban Land Institute, (Washington, 1962).

INTERNATIONAL URBAN RESEARCH, The World's Metropolitan Areas, (Berkeley: University of California Press, 1959).

LAMPARD, Eric E. "The Evolving System of Cities in the United States: Urbanization and Economic Development", in Harvey S. Perloff and Lowden Wingo, Jr. (eds.) Issues in Urban Economics, (Washington: Resources for the Future, 1968).

LAMPARD, Eric E. "The History of Cities in Economically Advanced Areas", Economic Development and Cultural Change, III, (January, 1955), pp.81-136.

LAW, C.M. "The Growth of Urban Population in England and Wales, 1801-1911", Transactions of the Institute of British Geographers, XLI, (1967).

LEWIS, Robert A. and ROWLAND, Richard H. "Urbanization in Russia and the U.S.S.R., 1897-1966", A.A.A.G., LIX, (December, 1969), pp. 776-796.

MEADOWS, Paul and MIZRUCHI, Ephraim H. (eds) Urbanism, Urbanization, and Change: Comparative Perspectives, (Reading, Mass.: Addison-Wesley, (1969).

McKELVEY, Blake The Urbanization of America, 1860-1915, (Rutgers University Press, 19).

McKELVEY, Blake The Emergence of Metropolitan America, 1915-1966, (Brunswick, N.J., Rutgers University Press, 1968).

MUMFORD, Lewis The City in History, (Harcourt, Brace and World, 1961).

MURPHEY, Rhodes "City as a Centre of Change", Annals of the A.A.G., XLIV, (1954), pp. 349-62.

PAPANNOUS, S.G. "Megalopolis: A First Definition", Ekistics, XXVI, (July, 1968), pp. 33-59.

PICKARD, Jerome Metropolitanization of the United States, Urban Land Institute, Resources Monograph #2.

PIRENNE, Henri Medieval Cities, (Princeton: Princeton University Press, 1925).

POPENOE, D. "On the Meaning of Urban in Urban Studies", Urban Affairs Quarterly, VI, (1965-66).

POUNDS, Norman J.G. "The Urbanization of the Classical World", Annals of the Association of American Geographers, LXIX, (March, 1969), pp. 135-57.

PRED, Allan The External Relations of Cities During 'Industrial Revolution', (Chicago: University of Chicago, Department of Geography, Research Paper No. 76, 1962).

RASHEVSKY, N. "Outlines of a Mathematical Approach to History", Bulletin of Mathematical Biophysics, XV, (1953), pp. 197-234 and pp. 339-365.

SJOBERG, G. The Pre-Industrial City, (Glencoe, Illinois: The Free Press, 1960).

THOMPSON, Wilbur R. A Preface to Urban Economics, (Washington: Resources for the Future, 1965), particularly Chapter I.

THOMPSON, W. S. "Urbanization", Encyclopedia of the Social Sciences.

UNESCO, Social Implications of the Industrialization and Urbanization in Africa South of the Sahara, (Paris, 1956).

UNESCO, Urbanization in Asia and the Far East, (Calcutta, 1957).

UNESCO, *Urbanization in Latin America,* (New York, 1961).

WADE, Richard C. *The Urban Frontier,* (Chicago: University of Chicago Press, 1959).

WEBBER, Melvin M. "The Post-City Age", *Daedalus,* XCVII, (Fall, 1968), pp. 1091-1110.

WEBER, Max *The City.* (New York: Collier Books, 1962).

WIRTH, Louis "Urbanism as a Way of Life", *American Journal of Sociology,* XLIV, (1938), pp. 1-24. Reprinted in Hatt & Russ, *Cities in Society.*

GEOGRAPHY 52

BIBLIOGRAPHY: LOCATION

ANDREWS, Howard F., *Working Notes and Bibliography on Central Place Studies*, University of Toronto, Department of Geography, Discussion Paper No. 8, 1970.

BECKMANN, Martin, *Location Theory*, (New York: Random House, 196).

BOS, H. C. *Spatial Dispersion of Economic Activity*, (Rotterdam: Rotterdam University Press, 1965).

BURTON, Ian, "A Restatement of the Dispersed City Hypothesis," *Annals of the A.A.G.*, LIII (September, 1963), pp. 285-289.

BERRY, Brian J. L., *Market Centers and Distribution Systems*. (Englewood Cliffs, N.J.: Prentice Hall, 1965).

BERRY, Brian J. L., *Theories of Urban Locations*, Resource Paper No. 1, Commission on College Geography, Washington, Association of American Geographers, 1968.

BERRY, Brian J. L. and GARRISON, W. L., "Recent Developments in Central Place Theory," *Papers and Proceedings of the Regional Science Association*, IV, (1958), pp. 107-120.

BERRY, Brian J.L. and PRED, Allen, *Central Place Studies: A Review of Theory and Applications*, (Philadelphia: Regional Science Research Institute, 1961) with *Supplement Through 1964* (1965).

CHRISTALLER, Walter, *Central Places in Southern Germany*, translated by Carlisle W. Baskin (Englewood Cliffs, N.J.: 1966).

CURRY, Leslie, "Central Places in the Random Spatial Economy," *Journal of Regional Science*, VII, 2 (Supplement) (1967), pp. 217-238.

CURRY, Leslie, "The Geography of Service Centers within Towns: The Elements of an Operational Approach," Proceedings of the I.G.U. Symposium in Urban Geography, Lund, 1960, *Lund Studies in Geography*, B XXIV, (1962), pp. 31-53.

CURRY, Leslie, "A 'Classical' Approach to Central Place Dynamics," *Geographical Analysis* I (July, 1969), pp. 272-282.

DACEY, Micheal F., "A Probabalistic Model for Central Place Locations," *Annals* of the A.A.G., LVI (September, 1966), pp. 550-568.

DACEY, Micheal F., "Population of Places in a Central Place Hierarchy," *Journal of Regional Science*, VI, 2, (Winter, 1966), pp. 27-34.

DACEY, Micheal F, "A County-seat Model for the Areal Pattern of an Urban System," *Geographical Review*, LVI, (October, 1966), pp. 527-542.

GOLLEDGE, R. G., RUSHTON, G. and CLARK, W.A.V., "Some Spatial Characteristics of Iowa's Dispersed Farm Population and Their Implications for the Grouping of Central Place Functions," *Economic Geography,* XLIII (July, 1966), pp. 361-372.

HARRIS, C. D. and ULLMAN, E. C., "The Nature of Cities," *Annals of the American Academy of Political and Social Science*, CCXLII, (1945), reprinted in Mayer & Kohn, pp. 277-286.

HUDSON, John C., "A Location Theory for Rural Settlement," *A.A.A.G.*,LIX, (June, 1969), pp. 365-381.

ISARD, Walter, *Location and Space-Economy* (Cambridge: M.I.T. Press, 1956).

KING, Leslie J., "A Multivariate Analysis of the Spacing of Urban Settlement in the United States," *Annals of the Association of American Geographers,* LI, (June, 1961), pp. 222-233.

KING, Leslie J., "Quantitative Expressions of the Pattern of Urban Settlements in Selected Areas of the United States," *Tidschrift voor Econimische en Sociale Geografie,* LIII, (January, 1962), p. 1-

LOSCH, August, *The Economics of Location,* translated by W. Stolper (New Haven: Yale University Press, 1952).

MEDVEDKOV, Y., V., "An Application of Topology in Central Place Analysis", *Papers and Proceedings Regional Science Association*, XX, (1968), pp. 77-84.

MEDVEDKOV, Y. V., "The Regular Component in Settlement Patterns as Shown on a Map," *Soviet Geography: Review and Translation*, VIII (May, 1967) pp. 150-168.

RICHARDSON, Harry W., *Regional Economics,* (New York: Praeges, 1969).

RUSHTON, Gerard, "Analysis of Spatial Behavior by Revealed Space Preference," *A.A.A.G.,* LIX, (June, 1969), pp. 391-400.

RUSSELL, Josiah C., "Metropolitan Regions in the Middle Ages," *Journal of Regional* Science II, 2, (1960), pp. 55-70.

STEVENS, Benjamin H., and BRACKETT Carolyn A., *Industrial Location,* (Philadelphia: Regional Science Research Institute, 1967).

THOMAS, Edwin N., "Toward an Expanded Central Place Model," *Geographical Review,* LI, (1961), pp. 400-411.

THOMAS, Edwin N., "The Stability of Distance-Population-Size Relationships for Iowa Town from 1900-1950," *Proceedings of the I.G.U. Symposium in Urban Geography,* (Lund, 1960), ed. K. Norborg, (Lund, 1967), pp. 13-29.

THOMAS, Edwin N., MITCHELL, Robert A., and BLOME, Donald A., "Spatial Behaviour of a Dispersed Non-Farm Population," Papers and Proceedings of the Regional Science Association, IX (1962), pp. 107-136.

UPPER Midwest Economic Study, Trade Centers and Trade Areas in the Upper Midwest, Urban Report No. 3, (Minneapolis: UMES, 1963).

VINING, Rutledge, "Description of Certain Spatial Aspects of an Economic System," Economic Development and Cultural Change, III, (1955), pp. 147-198.

WOLDENBERG, Micheal and BERRY, Brian J. L., "Rivers and Central Places: Analogues Systems," Journal of Regional Science, VII, (Winter, 1967).

BIBLIOGRAPHY: INTERACTION

ALCALY, Roger E., "Aggregation and Gravity Models: Some Empirical Evidence," Journal of Regional Science, VII, 1 (1967), pp. 61-73.

BERRY, BRIAN J. L., Essays on Commodity Flows and the Spatial Structure of the Indian Economy (Chicago: University of Chicago, Department of Geography, Research Paper No. 111, 1966).

BERRY, Brian J.L. and SCHWIND, Paul J., "Information and Entropy in Migrant Flows", Geographical Analysis, I (January, 1969), pp. 5-14.

BRAMS, Steven J., "Transaction Flows in the International System:, American Political Science Review, LX (December, 1966), pp. 880-898.

BRITTON, John N.H., " A Geographical Approach to the Examination of Industrial Linkages", Canadian Geographer, XIII, 3 (1969), pp. 185-198.

BROWN, Lawrence A., Diffusion Dynamics: A Review and Revision of the Quantitative Theory of the Spatial Diffusion of Innovation. Lund Studies in Geography, Series B., Lund, Sweden, Gleerup, 1967.

BROWN, Lawrence A., Diffusion Processes and Location: A Conceptual Framework and Bibliography, (Philadelphia: Regional Science Research Institute, 1969).

BROWN, Lawrence A., ODLAND, John and GOLLEDGE, Reginald, C., "Migration, Functional Distance, and the Urban Hierarchy", Economic Geography, XLVI (July, 1970), pp. 472-485.

CARROLL, Robert, "The Metropolitan Influence of the 168 Standard Metropolitan Area Central Cities", Social Forces, XLII (1963), pp. 166-73.

CLARK, W.A.V., RUSHTON, G. and COLLEDGE, R. G., "The Spatial Structure of the Iowa Urban Network", Geographical Analysis, II (July, 1970), pp. 301-313.

DAHL, Sven "The Contracts of Vasteras with the Rest of Sweden", Lund Studies in Geography, XIII, pp. 206-43.

DEUTSCH, Karl "Shifts in the Balance of Communication Flows: A Problem of Measurement in International Relation", Public Opinion Quarterly, XX (Spring, 1956), pp. 143-60.

DEUTSCH, Karl The Nerves of Government: Models of Political Communication and Control, (New York: The Free Press of Glencoe, 1963).

GARRISON, Wm. L., "Connectivity of the Interstate Highway System", Papers and Proceedings of the Regional Science Association, VI, (1960), pp. 121-37.

CARRISON, William L. and MARBLE, Duane F., A Prolegomenon to the Forecasting of Transportation Development, Research Report, The Transportation Center, Northwestern University, (Evanston, Illinois, 1965).

GLEJSER, H. and DRAMAIS, A., "A Gravity Model of Interdependent Equations to Estimate Flow Creation and Division", Journal of Regional Science, IX, 3 (December, 1969), pp. 439-50.

GOLLEDGE, R.G. and BROWN, L., "Search, Learning and the Market Decision Process" Geografiska Annaler, XLIX, B (1967), pp. 116-24.

HÄGERSTRAND, Torsten Innovation Diffusion as a Spatial Process, translated by Allen Pred, (Chicago: University of Chicago Press, 1967).

HÄGERSTRAND, Torsten "Migration and Area", Lund Studies in Geography, Series B, XIII, (1957), pp. 27-158.

HAGGETT, Peter and CHORLEY, Richard J., Network Analysis, (London: MacMillan, 1969).

HOWREY, E. Philip "On the Choice of Forecasting Models for Air Travel", Journal of Regional Science, IX, 2 (1969), pp. 215-224.

HUDSON, John C., "Diffusion in a Central Place System", Geographical Analysis, I (January, 1969), pp. 45-58.

KEYFITZ, Nathan Introduction to the Mathematics of Population, (Reading, Mass.: Addison-Wesley, 1968).

LIEBERSON, Stanley and SCHWIRIAN, Kurt "Banking Functions as an Index of Intercity Relations", Journal of Regional Science, IV, 1 (1962), pp. 69-81.

LINNEMANN, Hans An Econometric Model of International Trade Flows. Amsterdam: North Holland Publishing Co., 1966.

LOWRY, Ira S., Migration and Metropolitan Growth: Two Analytical Models, (Los Angeles: University of California, Institute of Government and Public Affairs, 1966).

MACKAY, J. Ross "The Interactance Hypothesis and Boundaries in Canada", Canadian Geographer, II (1958), pp. 1-8; reprinted in Berry and Marble (eds.) Spatial Analysis, pp. 122-129.

MORRILL, Richard L., "The Distribution of Migration Distances", Papers and Proceedings of the Regional Science Association, XI (1963) pp. 75-84.

MORRILL, Richard L., "Waves of Spatial Diffusion", Journal of Regional Science, VIII, 1 (1968), pp. 1-18.

MORRILL, Richard L., and PITTS, Forest "Marriage, Migration and the Mean Information Field", Annals of the Association of American Geographers, LVII (June, 1967), pp. 401-422.

NYSTUEN, John D. and DACEY, Micheal F., "A Graph Theory Interpretation of Nodal Regions", Papers and Proceedings of the Regional Science Association, VII (1961), pp. 29-42; reprinted in Berry and Marble (eds.) Spatial Analysis, pp. 407-418.

OLSSON, Gunnar "Distance and Human Interaction: A Migration Study", Geografiska Annaler, XLVII, B (1965), pp. 3-43.

OLSSON, Gunnar Distance and Human Interaction: A Review and Bibliography, (Philadelphia: Regional Science Research Institute Bibliography Series No. 2, 1965.

OLSSON, Gunnar "Central Place Theory, Spatial Interaction and Stochastic Processes", Papers and Proceedings of the Regional Science Association, XVIII, (1967).

OLSSON, Gunnar and GALE, Stephen "Spatial Theory and Human Behavior: A Study of Anarchistic Vector Space", Papers and Proceedings of the Regional Science Association, XXI (1968), pp. 229-242.

PETERSON, Paul Ove "Innovation Diffusion within and between National Urban Systems", Geographical Analysis, II (July, 1970), pp. 203-254.

PFOUTS, Ralph W., "Patterns of Economic Interaction in the Crescent", F. Stuart Chapin, Jr. and Shirley F. Weiss (eds.) Urban Growth Dynamics, (New York: John Wiley, 1962).

PHILBRICK, Allen K., "Principles of Areal Functional Organization in Regional Human Geography", Economic Geography, XXXIII (1957), pp. 299-336.

ROGERS, Andrei Matrix Analysis of Inter-Regional Population Growth and Description, (Berkeley and Los Angeles: University of California Press, 1968).

RUMMEL, R.J., "A Field Theory of Social Action with Application to Conflict within Nations", General Systems, X (1965), pp. 183-211.

RUSSETT, Bruce M., International Regions and the International Economy, (Chicago: Rand McNally, 1967).

SIMMONS, James W., Flows in an Urban Area: A Synthesis, Bell Canada Environment Study 36 (University of Toronto, 1968).

SMITH, Robert H. T., "Concepts and Methods in Commodity Flow Analysis", Economic Geography, XLVI, 2 (Supplement), (June, 1970) pp.404-416.

TAAFE, E.J., "Urban Hierarchy: An Air Passenger Definition", Economic Geography, XXXVIII (1962), pp. 1-14.

THORNTHWAITE, C. Warren Internal Migration in the United States, (Philadelphia: University of Pennsylvania Press, Study of Population Distribution, Bulletin No. 1, 1934).

ULLMAN, Edward L., American Commodity Flow, (Seattle: Univ. of Washington Press, 1957).

GEOGRAPHY 52

BIBLIOGRAPHY: DIFFERENTIATION

ALFORD, Robert and SCOBLE, Harry, "Political and Socioeconomic Characteristics of American Cities," *Municipal Yearkbook, 1965*, (Chicago: Int. Assoc. of City Managers, 1965), pp. 82-97.

AHMAD, Q. *Indian Cities: Characteristics and Correlates,* (Chicago: University of Chicago, Department of Geography, Research Paper No. 102, 1965).

BECKMANN, Martin J. and MCPHERSON, John C., "City Size Distribution in a Central Place Hierarchy: An Alternative Approach," *Journal of Regional Science*, X,(April, 1970), pp. 25-34.

BECKMANN, Martin J., "City Hierarchies and the Distribution of City Size," *Economic Development and Cultural Change*, VI, (1958), pp. 243-248.

BERRY, Brian J.L., "City Size Distribution and Economic Development," *Economic Development and Cultural Change*, IX, (July, 1961), pp. 573-588; reprinted in Friedmann and Alonso, pp. 138-152.

BERRY, Brian J.L., "American Urban Dimensions, 1960," (Chicago: University of Chicago, Center for Urban Studies, 1968) mimeo. (Geography Library).

BERRY, Brian J.L., City Size and Economic Development: Conceptual Synthesis and Policy Problems, with Special Reference to South and South-east Asia. I.C.U. Comm. on Quantitative Methods, Ann Arbor, August, 1969.

BERRY, Brian J.L. (ed.), *Classification of Cities: New Methods and Evolving Uses,* (Washington: International City Managers Association, 1970).

BERRY, B.J.L., and GARRISON, W. L., "Alternate Explanations of the Urban Rank Size Relationship," Annals of the A.A.G. XLVIII (March, 1958), pp. 83-91; reprinted in Mayer & Kohn pp. 230-239.

CURRY, Leslie, "Explorations in Settlement Theory: The Random Spatial Economy," *Annals of The Association of American Geographers*, LIV (March, 1964), pp. 138-146.

DOHERTY, J.M., 'Residential Preferences for Urban Environment in the United States," *Discussion Paper No. 29*, (London: Graduate School of Geography, London School of Economics, 1968).

DUNCAN, Otis, *et.al.,* *Metropolis and Region,* (Baltimore: Johns Hopkins, 1960).

FANO, P.L., "Organization, City Size Distribution and Central Places," *Papers and Proceedings of the Regional Science Association,* XXII, (1969), pp. 29-38.

HADDEN, J.K. and BORGATTA, E.F., *American Cities,* (Chicago: Rand McNally, 1965).

HOSELITZ, Bert L., "Generative and Parasitic Cities," *Economic Development and Cultural Change*, III, 3 (1955), pp. 278-294.

JEFFERSON, Mark, "The Law of the Primate City," *Geographical Review,* XXIX, (1939), pp. 226-232.

JOHNSTON, R.J., "Choice in Classifications: The Subjectivity of Objective Methods," *Annals of the Association of American Geographers*, LVIII, (September, 1968), pp. 575-589.

JONES, Kenneth J. and WYATT, C., "Toward a Typology of American Cities," *Journal of Regional Science,* X.2 (August, 1970), pp. 217-224.

KENYON, James B., "Other Relationship between Central Function and Size of Place," *Annals, A.A.G.*, LVII, (Dec. 1967), pp. 736-750.

LINSKY, Arnold S., "Some Generalizations Concerning Primate Cities," *Annals of the Association of American Geographers*, LV (1965), pp.506-513.

MADDEN, C.H., "Some Spatial Aspects of Economic Growth in the United States," *Economic Development and Cultural Change,* IV, (1956), pp.371-387.

MOSER, C.A. and SCOTT, W., *British Towns*, (London: Oliver and Boyal, 1961).

PARR, John B., "City Hierarchies and the Distribution of City Size: A Reconsideration of Beckmann's Contribution," *Journal of Regional Science,* IX, (1969), pp. 239-254.

REDFIELD, R. and SINGER, M.B., "The Cultural Role of Cities," *Economic Development and Cultural Change*, III, (1954).

ROSING, Kenneth E., "A Rejection of the Zipf Model (Rank Size Role) in Relation to City Size," *Professional Geographer* XVIII, (March, 1966), pp. 75-82.

SIMON, Herbert, "On a Class of Skew Distribution Functions," in *Models of Man*, (New York: Wiley, 1957), pp. 145-164.

SMITH, R.H.T., "Method and Purpose in Functional Town Classification," *Annals of the A.A.G.*,LV, (September, 1965), pp. 539-548.

STEWART, Charles T., "The Size and Spacing of Cities," *Geographical Review,* XLVIII, (1950), pp. 222-245, reprinted in Mayer & Kohn, pp.240-256.

THOMAS, Edwin N., "Additional Comments on Population Size Relationships for Sets of Cities," in W.L. Garrison and D.F.Marble (eds.) *Quantitative* Geography, Part I, (Evanston: Northwestern University Department of Geography, 1967), pp. 167-190.

WARD, Benjamin, "City Structure and Interdependence," *Papers and Proceedings of the Regional Science Association,* X (1963), pp. 207-221.

WEBB, John W., "Basic Concepts in the Analysis of Small Urban Centers of Minnesota," *Annals of the A.A.G.*, XLIX, (March, 1959), pp. 55-74.

WOOD, Robert C., *1400 Governments*,(New York: Harvard University Press, 1961).

Bibliography: Growth and Change

BERRY, Brian J.L., "Impact of Expanding Metropolitan Communities upon a Central Place Hierarchy," Annals of the Association of American Geographers, L (1960), pp. 112-117.

BERRY, Brian J.L., "Cities as Systems within Systems of Cities," Papers and Proceedings of the Regional Science Association, XIII (1969), pp. 147-164.

CZAMANSKI, Stanislaw, "A Model of Urban Growth," Papers and Proceedings of the Regional Science Association, XIII (1964), pp. 177-200.

FRIEDMANN, John, "Economic Growth and Urban Structure in Venezula," Papers and Proceedings of the Regional Science Association, Latin America, I (1962)

FUGUITT, Glenn V. "Trends in Incorporated Places, 1950-60," Demography II, (1965), pp. 363-371.

GAUTHIER, Howard L., "Transportation and the Growth of the Sao Paulo Economy." Journal of Regional Science, VIII (Summer, 1968), pp. 77-94.

HART, John F. and SALISBURY, Neil E., "Population Change in Middle Western Villages: A Statistical Approach," Annals of the Association of American Geographers, LV, (March, 1965), pp. 140-160.

HART, John F., SALISBURY, Neil E., and SMITH, Everett, G. Jr., "The Dying Village and Some Notions about Urban Growth," Economic Geography, XLIV, (October, 1968), pp. 343-349.

HARVEY, David, "Models of Spatial Patterns in Human Geography," in Richard J. Chorley and Peter Haggett, Models in Geography (London: Methuen 1967), pp. 549-608.

HIGGS, Robert, "The Growth of Cities in a Midwestern Region, 1870-1900," Journal of Regional Science, IX, 3 (December, 1969), pp. 359-376.

LUKERMANN, Fred, "Empirical Expressions of Nodality and Hierarchy in a Circulation Manifold," East Lakes Geographer, (August, 1966), pp. 17-44.

MEDVEDKOV, Y. V., "The Concept of Entropy in Settlement Pattern Analysis," Papers, Regional Science Association, XVII (1967), pp. 165-168.

MEIER, Richard L., A Communications Theory of Urban Growth. (Cambridge: MIT, 1964).

MILLER, James C., "Living Systems," Behavioral Science, X (1965); "Basic Concepts," pp. 193-237; "Structure and Process," pp. 377-379; "Cross-level Hypothesis," pp. 350-411.

MORRILL, Richard L., "Simulation of Central Place Patterns Over Time," Proceedings of the I.G.U. Symposium in Urban Geography, Lund, 1960, Lund Studies in Geography, XXIV (1962), pp.

MORRILL, Richard L., "Development of Spatial Distribution of Towns in Sweden: An Historical - Predictive Approach," *Annals of the A.A.G.*, LIII (March, 1963), pp. 1-14.

MORRILL, Richard L., *Migration and the Spread and Growth of Urban Settlement*, Lund Studies in Geography, No. 26 (Lund, 1965).

NORTHAM, Ray M., "Declining Urban Centers in the United States, 1940-60," *Annals of the Association of American Geographers*, LIII (March, 1963), pp. 50-59.

NOURSE, Hugh O., *Regional Economics* (New York: McGraw-Hill, 1968), Chapter III "Systems of Cities",

PERLOFF, Harvey S. and WINGO, Lowden S., *Issues in Urban Economics* (Baltimore: John Hopkins Press, 1968), particularly the articles by Thompson, "Internal and External Factors in the Development of Urban Economies" and Lampard, "The Evolving System of Cities in the United States: Urbanization and Economic Development."

PRED, Allen R. "Industrialization and Urbanization as Interacting Spatial Processes", in S.B. Cohen, (ed.), *Problems and Trends in American Geography* (1967)

PRED, Allen, R., *Behavior and Location. Foundations for a Geographic and Dynamic Locations Theory Part I* (Lund: Gleerups, 1967).

PRED, Allen, R., *The Spatial Dynamics of U.S. Urban and Industrial Growth, 1800-1914 Theoretical and Interpretive Essays*, (Cambridge. MIT Press, 1967)

RODWIN, Lloyd. *Nations and Cities: A Comparison of Strategies for Urban Growth* (Cambridge: MIT Press, 1970).

SIEBERT, Horst, *Regional Economic Growth: Theory and Policy* (Scranton, Pa: International Textbook, 1969).

THOMPSON, Wilber R., "Internal and External Factors in the Development of Urban Economics".

THOMPSON, Wilber, R., and MATTILA, John M. "Towards an Econometric Model of Urban Economic Development," in Harvey S. Perloff and Lowden Wingo, *Issues in Urban Economics* (Baltimore: John Hopkins, 1968).

SMOLENSKY, Eugene, and RATAJCZAK, D., "The Conception of Cities," *Exploration in Entrepreneurial History*, II (Winter, 1965), pp. 90-131.

WILLIAMSON, Jeffery G. and SWANSON, Joseph A., "The Growth of Cities in the American Northeast, 1820-1870," *Explorations in Entrepreneurial History*. IV, I (Supplement), 1966.

GEOGRAPHY 52

BIBLIOGRAPHY: STUDIES OF THE CANADIAN URBAN SYSTEM

AMBROSE, Peter J., "Some Technique for Measuring Change in Employment Structure", *Tijdschrift voor Economische en Sociale Geografie*, LVIII (March-April, 1967) pp. 76-81.

AMBROSE, Peter, "Patterns of Growth in the Canadian Labour Force 1951-1961," *Canadian Geographer* XIV (Summer, 1970) pp. 139-157.

ARMSTRONG, F.H. "Metropolitanism and Toronto Re-examined, 1825-1850", *Canadian Historical Association*, (1966), pp. 29-40.

ARMSTRONG, Frederick H. "Urban History in Canada," *Urban History Group Newsletter* No. 28, (December, 1969).

BURGHARDT, Andrew F., "The Origin and Development of the Niagara Peninsula, Ontario, 1770-1851, *Annals of the A.A.G.*, LIX (September, 1969), pp. 417-440.

CAMU, Pierre, "Les Ports de la Province de Quebec," *Cahiers de Geographie de Quebec*, III, 6 (Avril-Septembre, 1959), pp. 393-402.

CANADIAN COUNCIL ON URBAN AND REGIONAL RESEARCH, *Urban and Regional References 1945-1966* (Ottawa: 1968).

CARELESS, J.M.S., "Frontierism, Metropolitanism, and Canadian History", *Canadian Historical Review* XXXV (March, 1954), pp. 1-21.

CARELESS, J.M.S., "Metropolitanism and Nationalism," in P. Russell (ed.) *Nationalism in Canada,* (Toronto: McGraw-Hill, 1966).

CAZELIS, Pierre, "Sherbrooke: sa place dans la vie de Relations des Cantons de l'Est," *Cahiers de Geographie de Quebec* VIII (Avril-Septembre, 1969), pp. 165-194.

CROSS, Kevin J., *Urban Development in Canada*, (unpublished Ph.D., Cornell, 1958).

DUBE, Yves *et al.*, *Housing and Social Capital* Royal Commission on Canada's Economic Prospects, vol. XXIII (Ottawa, 1957), Chapter II, "Urbanization".

GOHEEN, Peter G. "The Central Places of Southern Ontario: A Geographic Study of their External Relations", Unpubl. M.A. Clark Univ. 1964.

GOODCHILD, M.F. and MASSON, B.H., "Some least-cost models of Spatial Administrative Systems in Southern Ontario," *Geografiska Annaler*, LIIB (1969) 2 pp. 86-94.

GREER-WOOTTEN, Bryn *The Spatial Structure of the Urban Field* (Unpublished Ph.D. McGill, 1968).

HABITAT, "The Centennial Issue", X, No. 3-6 (1967)

HODGE, Gerald, "The Identification of 'Growth Poles' in Eastern Ontario" Report to Ontario Department of Economics and Development, (Toronto, 1966)

HODGE, Gerald, "The Prediction of Trade Center Viability in the Great Plains", Papers and Proceedings of the Regional Science Association, XV (1965) pp. 87-115.

HODGE, G., "Do Villages", Rural Sociology, XXXI (June, 1966).

KASAHARA, Yoshiko, "Profile of Canada's Metropolitan Areas," Queen's Quarterly, LXX (Autumn, 1963) pp. 303-13.

KERR, Donald P., "Some Aspects of the Geography of Finance in Canada," Canadian Geographer, IX (1965), pp. 175-192.

KERR, Donald P., "Metropolitan Dominance in Canada," in John Warkentin (ed.) Canada, A Geographical Interpretation (Methuen: Toronto, 1968).

KERR, Donald P. and SPELT, Jacob, "Some Aspects of Industrial Location in Southern Ontario", Canadian Geographer 1960, pp. 12-25.

KING, Leslie, J., "Discriminant Analysis of Urban Growth Patterns in Ontario and Quebec, 1951-1961." Annals of the A.A.G. LVII (1967) pp.566-578.

KING, Leslie, J. "Cross-Sectional Analyses of Canadian Urban Dimensions, 1951 and 1961," Canadian Geographer, X, 4 (1966), pp. 205-24.

KIRK, Donald W., "Southwestern Ontario: The Areal Pattern of Urban Settlement in 1850" unpublished Ph.D. Northwestern, 1949.

KISSLING, C.C., "Linkage Importance in a Regional Highway Network", Canadian Geographer, XIII, 2 (1969) pp. 113-127.

KISSLING, C.C., "Accessibility and Urban Economic Structure" New Zealand Geographer.

LITHWICK, N.H., and PAQUET, Gilles, Urban Studies: A Canadian Perspective (Toronto: Methuen, 1968): Particularly Lithwick and Paquet "Urban Growth and Regional Contagion"; and Pine "Social Consequences of Urbanization".

MARSHALL, John V., The Location of Service Towns (University of Toronto, Department of Geography, Research Publication No. 3, 1970).

MASTERS, Donald C., "Toronto Versus Montreal: The Struggle for Financial Hegemony, 1680-1875," Canadian Historical Review, XXII (June, 1941) pp. 133-146.

MAXWELL, James W., "The Functional Structure of Canadian Cities: A Classification," Geographical Bulletin, VII, 2 (1965), pp. 79-104.

MURDIE, Robert, "Cultural Differences in Consumer Travel," Economic Geography, XLI (July, 1965), pp. 211-233.

PARKER, W.H. "The Towns of Lower Canada in the 1830's," in R.P. Beckinsale and J.M. Houston (eds.) Urbanization and Its Problems (Oxford: Basil Blackwell, 1963).

PEARSON, Norman A., "Conurbation Canada," Canadian Geographer, IV, 4 (1961) pp. 101-107.

PEARSON, Norman, "From Villages to Cities", N.M.S. Careless and R.C. Brown (eds.) The Canadians, 1867-1967 (Toronto, 1967).

RACINE, Jean-Bernard, "La Croissance de Grand-Montreal au Sud du Saint Larent: Le Cas de Saint Bruno de Montarville" Revue de Geographie de Montreal (1967) XXI, 1, pp. 111-148.

RACINE, Jean-Bernard, "Exurbanization et metamorphisime peri-urbain" Revue de Geographie de Montreal, XXI, 2 (1967), pp. 313-342.

RASHLEIGH, Edward T., "Observations on Canadian Cities, 1960-61," Plan Canada, III (September, 1962), pp. 60-77.

RAY, D. Micheal, Market Potential and Economic Shadow (Chicago: University of Chicago, Department of Geography, Research Paper No. 101, 1965).

RAY, D. Michael, "The Spatial Structure of Economic and Cultural Difference: A Factorial Ecology of Canada," Papers and Proceedings of the Regional Science Association, XXIII (1969). pp. 7-24.

RAY, D.M. and MURDIE, R.A. "Socio-Economic Dimensions and Spatial Structure of Canadian Cities," (Waterloo, University of Waterloo, Department of Geography, 1968) -

ROBINSON, Ira, M., New Industrial Towns on Canada's Research Frontier (Chicago: University of Chicago, Department of Geography, Research Paper No. 73, 1962).

RUSSWURM, Lorne, H., "Expanding Urbanization and Selected Agricultural Elements; Case Study Southwestern Ontario, 1941-1961", Land Economics XLIII (February, 1967), pp. 101-107.

RUSSWURM, Lorne R. The Development of an Urban Corridor System, Toronto-Stratford, 1941-1966, Report to the Regional Development Branch, Ontario Department of Economics and Development, 1969.

SASKATCHEWAN, ROYAL COMMISSION ON AGRICULTURE AND RURAL LIFE, Service Centres, Report No. 12 (Regina: Queen's Printers, 1957).

SCHNORE, Leo F. and PETERSEN, Gene B., "Urban and Metropolitan Development in the United States and Canada," Annals of the American Association of Political and Social Science CCCXVI (1958) pp. 60-68.

SEMPLE, R.K., Regional Types of Variability within a System of Urban Places, Unpublished Ph.D. Dissertation, Ohio State University (Columbus, Ohio: 1969).

SEMPLE, R.K. "An Oblique 'Simple Structure' Factor Analysis of Viability Measures for Southern Ontario Towns," University of Toronto, Department of Geography Discussion Paper No. 2 (October, 1969).

SEMPLE, R.K. and WANG, L.H., "A Geographical Analysis of Redundancy in the Interurban Transportation Links," University of Toronto, Department of Geography, Discussion Paper No. 5 (1970).

SIMMONS, James W. and SIMMONS, Robert E., Urban Canada (Toronto: Copp Clark, 1969). Chapters II, III and IV.

SLATER, David W., "Political Economy of Urban Changes in Canada," Queen's Quarterly LXVII (Winter, 1960-61), pp.

SEMPLE, R. Keith, CASETTI, Emilio, and KING, Leslie, J., "The Determination of the Optimal Number of Groupings in Classification Problems," Discussion Paper No. 10, Department of Geography, Ohio State University (Columbus, Ohio, 1969).

SLATER, David W., "Decentralization of Urban People and Manufacturing Activity in Canada," Canadian Journal of Economics and Political Science XXVII (February, 1961), pp. 72-84.

SPELT, Jacob, Urban Development of South-Central Ontario (Assen, Netherlands: Van Gorcum, 1955).

STONE, Leroy O. Urban Development in Canada (Ottawa: Dominion Bureau of Statistics, 1967).

STONE, Leroy O., Migration in Canada: Regional Aspects, Census Monograph (Ottawa: Dominion Bureau of Statistics, 1969).

TROTIER, Louis, Some Function Characteristics of the Main Service Centers of the Province of Quebec Melange geographices Canadiens affect a Raoul Blanchard Quebec Les Presses Universitaires Laval, 1959, pp. 243-59. also Cahiers de Geographie de Quebec III, (Apr-Sept. 1959) 6, pp. 243-59.

WATSON, J. Wrefred, "Urban Development in the NiagaraPeninsula," Canadian Journal of Economics and Political Science, IX (Nov. 1943) pp. 463-486.

WHEBELL, C. "Corridors: A Theory of Urban Systems," Annals of the Association of American Geographers, LIX (March, 1969), pp. 1-26.

APPENDIX 5

Student Projects

1. A Gaming Model of the Pre-Industrial City
2. Socialist City Game
3. Interstate

Appendix 6

THE MUNIFICENT HEXAGON

Geography 52
Final Examination
Professor John Sommer

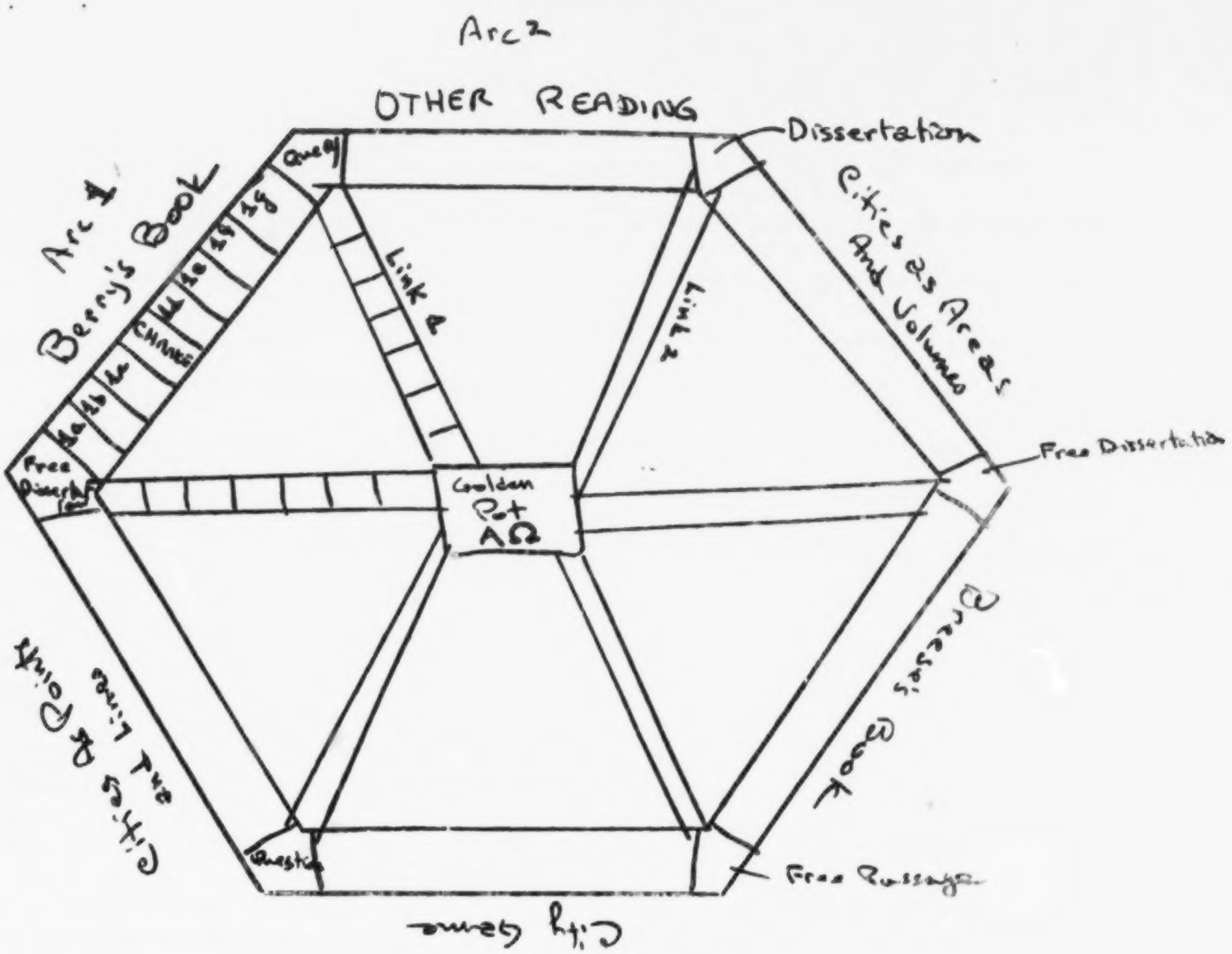
THE MUNIFICENT HEXAGON

Introduction:

The Munificent Hexagon is a gaming examination for students of urban geography. The student is the Player and the professor is the Guide in a game that takes the form of an oral examination. The questions asked are determined, in part by chance, and in part by the play of the student. The game encompasses the whole course and is designed to be as fair as possible to all players. The aim of the game is to accumulate as many points as possible up to 1000 in forty minutes by traversing the game board answering questions (where possible) on each space where the Player's piece lands.

The game is flexible in that the Player may chose (within some constraints) from what parts of the course he or she will answer questions, may choose between general or specific types of questions, and may (in certain circumstances) quiz the professor and grade his answer.

The game is played on an hexagonal playing board that is made up of nodes, arcs and links, each of which is labeled so that the player may direct his piece to the portion of the board where he chooses to answer questions. On the next page an example of the board is presented, and on the following pages are the rules of play and a description of the different parts of the game.


Arc 2
OTHER READING
Dissertation
Cities as Areas And Volumes
Free Dissertation
Dresser's Book
Free Passage
City Game
Cities of Point and Line
Question
Free Dissertation
1a
1b
1c
CHANCE
1d
1e
1f
1g
Query
Arc 1
Berry's Book
Link A
Link 2
Golden Pot
AΩ

Schema for the Munificent Hexagon

RULES

Procedure:

1. Play begins when the player rolls two dice and moves his piece from the Golden Pot as many segments as are shown on the upper faces of the dice.
2. Upon reaching a node the piece may be moved either to the right or left along an arc.
3. No link may be retraced toward the Golden Pot without first landing on an arc segment. A link may be retraced toward a node.
4. No arc may be retraced without first landing on another arc's segment or on a link segment.
5. Landing On (a segment or node) means the termination point of any roll of the dice where this point may be arrived at from only one direction--in other words, the player may not roll a "six" and advance four and then retreat two so that only two "real space" segments would have been traversed.
6. When an arc or link question has been landed on the player must either answer or refuse to answer it, but in either case that segment is neutral thereafter.
7. If a player lands on a neutralized segment (shown by some marker) he or she may choose to move to the next "live" segment or roll again.
8. The game ends when forty minutes have elapsed, or when there are no more arc segments, link segments, question cards, dissertation cards, or free dissertation possibilities remaining.

Points:

Points are almost always awarded by the Guide. Below is a table of point totals with a column showing the suggested number of minutes for answering a question. Keep in mind that a minute is worth about twenty-five points.

Type of Award	Total Points Possible	Time [illegible]
Free Dissertation	200	5 minutes
Dissertation	200	7
Arc Questions	100	4
Link Questions	20	1
Question (available after 500)	50	2
Query Cards (redeemable)	15	0
Golden Pot	10 (each landing)	0

Links·

Six links are the spokes of the Hexagon, tying the nodes to the Golden Pot. Each link is divided into seven segments and each segment bears a question related to the two arc topics connected to the node; thus, Link 1 is connected to the Query node and bears questions related to Berry's book and to Other Readings. These questions are the most specific in the game, are worth twenty points and are awarded at the discretion of the director.

Arcs:

There are six arcs on the Hexagon, each divided into eight segments, and bounded by a node at each terminus. Seven of the arc-segments are questions and one arc-segment is a Chance (see Chance Cards). Each arc deals with a different part of the reading for the Geography 52 course and they are clearly labelled as such, thus:

Arc 1: Berry's book
Arc 2: Other Reading
Arc 3: Cities as Areas and Surfaces
Arc 4: Breese's book
Arc 5: City Model
Arc 6: Cities as Points and Lines

The questions on the arcs tend to be general in nature relative to link questions, but not as general as Dissertation questions (see Dissertation Cards). A maximum of 100 points may be received for an answer to an arc question and points are awarded at the discretion of the Guide.

Nodes:

There are seven nodes on the Munificent Hexagon, one at the center called the Golden Pot, and six which define the joins between two arcs and a link. These nodes have different requirements and possibilities:

1. Query: a player receives a Query Card when he lands on this node (see Query Card).
2. Dissertation: a player receives a Dissertation Card when he or she lands on this node (see Dissertation Card)
3. Free Dissertation: A player who lands on either of the _two_ Free Dissertation nodes must immediately present a dissertation of at least five minutes duration. This dissertation may be on any topic in urban geography, and may receive up to 200 points at the discretion of the Guide. Once landed upon, the node is neutralized and is, thereafter, like any arc or link segment that has been covered.
4. Free Passage: Allows the player to advance immediately to any arc or link segment, but not to any node or to the Golden Pot.
5. Question: If a player who has accumulated at least 500 points lands on this node he or she may formulate a question for the Guide to answer. The Guide has two minutes to complete his answer. The Player then decides how many points (0 to 50) to assign for the answer and subtracts this from the total possible (50), and adds the residual to his or her score.
6. The Golden Pot: is the origin of play, and can, if chosen, also be the end of play (see Benevolent Chance Cards). This central place is nearest to all other places in the game and, when passed through, allows the player to choose what link to follow. In other words, if a player is headed potward, (said to be "going to pot"), on a link and rolls a number

that carries him further than the Golden Pot, he may choose any of the other five links for exit to an arc. Should the player roll a number that allows him to land directly on the Golden Pot he or she receives ten points and the option to traverse any of the six links in exit to an arc.

Query Cards:

There are nineteen Query Cards, three for each arc of the Hexagon, plus one Unencumbered Query. Query cards are acquired during the course of play when the player lands on the Query node, and may be retained until they are needed.

When a player reaches an impass while attempting to answer a question he or she may play a Query card (if one has been obtained that corresponds to the arc from which the question is drawn) and the Guide will provide a clue to the answer. The Unencumbered Query may be used at any time for any arc or link.

No points are awarded for the cards as such, but any unplayed cards in the player's possession at the end of the game may be redeemed for fifteen points each.

Chance Cards:

There are a total of nineteen Chance Cards, divided into three kinds: advance and retreat cards which direct the player to go forward or backward a certain number of spaces; relocation cards which direct the player to go to a certain arc location, and point challenge cards which allow a player (after 500 points have been attained) to challenge the Guide's decision to allocate a certain number of points for an answer.

Advance and retreat cards require the player to move even though the new location has already been exhausted. The player must simply roll again. Relocation cards may send a player to a particular segment only if that segment is unused. If it has been neutralized the player rolls again.

Point challenges are discussed after the play at an agreed upon time.

Dissertation Cards:

When a player lands on Dissertation he or she receives a card with a topic on it. The player may play this card at any time by putting it on the board and speaking to the topic, however, a player may accumulate only one dissertation card, thus, if a dissertation card is held and the dissertation node is landed upon again, the player must make his dissertation immediately. He then must draw another dissertation card to hold until he chooses, or is forced, to use it.

The dissertation topics tend toward generality and synthesis and result in the award of 200 points for a totally successful dissertation. The Guide awards the points.

Benevolent Chances:

A Pile of Benevolent Chances await the player who terminates his game at the Golden Pot. The player who terminates his game in this manner draws a card from the pile and receives a material reward.

APPENDIX 7

BLUE CITY VIDEOTAPE

This videotape is available through the Office of Instructional Services, Fairbanks Hall, Dartmouth College, Hanover, New Hampshire 03755.

APPENDIX 8

Economic A

		Fall		Spring	
R Type	#	Sales	Net Income	Sales	Net Income
4 RA	4	5 821	1 818	5 772	1 786
RB	2	9 433	2 328	9 329	2 214
RC	1	25 066	8 917	25 066	8 975
NS	1	105 544.05	9 380.295	105 544.05	10 970.049
PS	1	27 302	-12 036.334	26 367	-12 471.57
	R3	122 793.743	226 818.341		
flow --		98 591.779	230 967.670	108 990.74	235 906.631
5 RA	4	5 495	1 938	5 446	1 936
RB	2	9 316	3 183	9 329	3 244
RC	1	25 066	9 238	25 066	9 296
NS	1	102 409.05	12 561.524	102 409.05	12 580.296
PS	1	43 240	-21 846.184	36 020	-12 157.12
flow --		88 779.217	245 612.725	109 634.53	261 008.038
6 RA	4	6 580	2 464	6 066	2 181
RB	2	11 615	4 277	9 473	3 413
RC	1	24 926	9 009	25 066	9 155
NS	1	104 500	13 594.453	104 500	12 998.238
PS	1	49 830	-19 832.314	40 726.5	-37 580.2
flow --		75 119.9	237 216.357	-34 454.534	225 366.523
7 RA	4	7 360	2 744	7 360	2 833
RB	2	20 298	7 535	25 885	10 110
RC	1	24 926	9 088	25 066	9 237
NS	1	106 589.05	14 357.065	112 199	14 621.324
PS	1	54 220	-20 706.502	------	------
flow --		46 642.691	255 757.842	50 969.636	295 100.39

Economic B

R Type #		Fall		Spring		
		Sales	Net Income	Sales	Net Income	
4 RA	4	3 841	854	4 421	1 194	
RB	2	7 560	2 510	7 560	2 536	
BS	1	103 400	6 678.312	118 580	9 078.846	
PS	1	64 733	3 043.54	65 198.5	3 235.06	
	R3	138 350.714	127 066.687			
flow --		83 210.526	75 502.211	78 923.08	76 874.765	
5 RA	4	4 253	1 236	4 249	1 243	
RB	3	12 041	1 559	12 041	1 624	
BS	1	170 100	-7 976.19	171 200	-3 462.33	
PS	1	56 857.5	2 346.335	63 536	3 160.834	
PG	1	240	-12 799.8	240	-10 350.3	
flow --		62 960.797	120 433.067	66 481.736	129 614.006	
6 RA	5	4 253	1 277	4 249	1 297	
RB	3	11 994	2 935	11 994	3 012	
BS	1	174 300	-6 275.37	182 700	1 179.351	
PS	1	61 313	2 194.902	61 173	1 238.64	
PG	1	100 197	-894.5	65 866.5	-4 621.738	
flow --		56 516.886	116 452.045	34 730.673	114 689.832	
7 RA	5	4 755	1 528	4 249	1 311	
RB	3	12 750	3 959	14 168	4 259	
BS	1	179 800	-4 051.17	202 180	7 915.229	
PS	1	59 726.5	1 745.732	114 710	-52 096.52	PS2
PG	1	133 362	4 138.494	65 977	-5 396.338	
flow --		69 546.428	128 997.721	-45 181.293	77 101.265	

Economic C

R	Type	#	Fall		Spring	
			Sales	Net Income	Sales	Net Income
4	RA	6	3 775	875	3 775	815
	RB	1	5 670	406	5 805	492
	RC	1	9 858	2 590	9 972	2 676
	LI	1	17 135	-29 649.32	57 155	-2 361.82
	BG	1	421 520	30 890.992	434 260	29 404.714
	HI	1	143 895.735	14 627.029	159 884.15	19 423.48
	R3		64 525.758	256 405.668		
flow --			83 357.879	360 551.439	108 543.961	385 747.521
5	RA	6	3 853	1 329	3 800	1 334
	RB	1	5 805	1 857	5 805	1 876
	RC	1	9 858	3 336	9 972	3 421
	LI	1	50 977.893	-4 699.091	50 977.893	-4 631.591
	BG	1	412 280	29 138.097	413 930	29 341.453
	HI	1	140 122.307	11 914.031	150 194.15	14 854.735
flow --			109 824.775	390 271.899	139 044.083	419 491.207
6	RA	6	4 913	1 715	4 863	1 723
	RB	1	9 988	1 836	9 941	1 878
	RC	1	9 858	3 256	9 972	3 352
	LI	1	73 592.447	3 553.226	102 556.09	14 063.641
	BG	1	423 500	30 332.599	427 020	31 723.368
	HI	1	153 424.15	16 351.061	148 189.679	12 948.28
flow --			53 477.448	455 313.789	199 398.202	470 104.543
7	RA	6	5 108	1 819	4 863	1 732
	RB	1	11 414	3 932	9 987	3 296
	RC	1	9 858	3 297	9 972	3 420
	LI	1	75 775.154	3 942.006	105.569.1	14 582.739
	BG	1	462 660	34 566.333	455 840	34 608.51
	HI	1	137 180	10 549.451	161 500	18 864.212
	PG	1	-----	-------	0	-22 502.3
flow --			89 008.79	505 423.387	181 698.028	567 476.626

TOTALS A, B, C,

		Fall		Spring		
R Type	#	Sales	Net Income	Sales	Net Income	
4 RA	14	13 437	3 547	13 968	3 795	
RB	5	22 663	5 244	22 694	5 242	
RC	2	34 924	11 507	35 038	11 651	
HI	1	143 895.735	14 627.029	159 884.15	19 423.48	
LI	1	17 135	-29 649.32	57 155	-2 361.82	
NS	1	105 544.05	9 380.295	105 544.05	10 970.049	
BS	1	103 400	6 678.312	118 580	9 078.846	
BG	1	421 520	30 890.992	414 260	29 404.714	
PS	2	92 035	-8 992.794	91 565.5	-9 236.51	
	R3	325 670.215	612 290.696			
flow --		265 160.184	667 021.32	296 457.781	698 528.917	
5 RA	14	13 601	4 503	13 495	4 513	
RB	6	27 162	6 599	27 175	6 744	
RC	2	34 924	12 574	35 038	12 717	
HI	1	140 122.307	11 914.031	150 194.15	14 854.735	
LI	1	50 977.893	-4 699.091	50 977.893	-4 631.591	
NS	1	102 409.05	12 561.524	102 409.05	12 580.296	
BS	1	170 100	-7 976.19	171 200	-3 462.33	
BG	1	412 280	29 138.097	413 930	29 341.453	
PS	2	100 097.5	-18 499.849	99 556	-8 996.286	
PG	1	240	-12 799.8	240	-10 350.3	
flow --		261 564.789	756 317.691	315 160.349	810 113.251	
6 RA	15	15 746	5 456	15 178	5 201	
RB	6	33 597	9 048	31 408	8 303	
RC	2	34 784	12 265	35 038	12 507	
HI	1	153 424.15	16 351.061	148 189.679	12 948.28	
LI	1	73 592.441	3 553,226	102 556.09	14 063.641	
NS	1	104 500	13 594.453	104 500	12 998.238	
BS	1	174 300	-6 275.37	182 700	1 179.351	
BG	1	423 500	30 332.599	427 020	31 723.368	
PS	2	111 143	-17 637.412	101 899.5	-36 341.56	
PG	1	100 197	-894.5	65 866.5	-4 621.738	
flow --		185 114.234	808 982.191	199 674.341	810 160.898	
7 RA	15	17 223	6 091	16 472	5 876	
RB	6	44 462	15 426	50 040	17 665	
RC	2	34 784	12 385	35 038	12 657	
HI	1	137 180	10 549.451	161 500	18 864.212	
LI	1	75 775.154	3 942.006	105 569.1	14 582.739	
NS	1	106 589.05	14 357.065	112 199	14 621.324	
BS	1	179 800	-4 051.17	202 180	7 915.229	
BG	1	462 660	34 566.333	455 840	34 608.51	
PS	2	113 946.5	-18 960.77	114.710	-52 096.52	
PG	1	133 362	4 138.494	65 977	-27 898.638	PG 2
flow --		205 197.909	890 178.95	187 486.371	939 678.281	

Examination by sector, E-E, E-F, E-G

abs. Sales: growth
net income: profitability
Sector's profits in
balance net worth

			Fall Old ('000s)	Economic E	Spring New	
Round	Type	#	Sales	Net Income	Sales	Net Income
4	RA	5	9057	3053	9517	3300
	RB	1	2240	569	2133	545
	RC	2	10425	1111	9495	270
	H1	1	169289.1	23823.254	157815.061	19242.372
	PG	2	216628	21788.877	223640	24250.222
	flow -- (cash bal.)		116556.636	(nw) 463086.263	140117.566	469107.193
5	RA	5	8947^{-}	3077^{+}	9517	3383^{+}
	RB	1	2240	767^{+}	2133	719^{+}
	RC	2	11562^{+}	2441^{+}	11355	2322^{+}
	H1	1	135174.735^{-}	9406.026^{-}	145776.675^{-}	13754.679^{-}
	PG	2	20766^{-}	-984.156^{-}	203426^{-}	-4790.257^{-}
	flow		78243.112^{-}	485000.508^{+}	103496.274^{-}	492713.670^{+}
6	RA	5	8947	3037^{-}	9517	3173^{-}
	RB	1	2240	753^{-}	2133	706^{-}
	RC	2	14829^{+}	4081^{+}	11355	2374^{+}
	H1	1	162449.1^{+}	20389.803^{+}	138081.735^{-}	10776.012^{-}
	PG	2	148040	-18364.953^{-}	176970^{-}	-10886.014
	flow --		57615.557^{-}	502580.336^{+}	104704.272^{+}	508379.051^{+}
7	RA	5	8877^{-}	3023^{-}	10237^{+}	3229^{+}
	RB	1	2240	759^{+}	2133	719^{+}
	RC	2	17735^{+}	5499^{+}	11295^{-}	2371^{-}
	H1	1	17100^{+}	23529.124^{+}	159410^{+}	19911.809^{+}
	PG	2	108729^{-}	37017.736^{-}	166532^{-}	-29069.256^{-}
	flow --		48238.278^{-}	454378.691^{-}	91074.764^{-}	515309.577^{+}
				Economic F		
4	RA	5	4441	1454	4441	1457
	RB	2	12301	4179	12301	4200
	RC	1	10087	3333	10087	3282
	C1	1	106100	20181.732	171100	34422.321
	flow --		114426.338	242135.231	10894.582	237603.475
5	RA	5	4824^{+}	1607^{+}	4876^{+}	1653^{+}
	RB	2	14801^{+}	5178^{+}	14681^{+}	5183^{+}
	RC	1	20287^{+}	6731^{+}	20175^{+}	6913^{+}
	C1	1	48000^{-}	6178.974^{-}	48000^{-}	6178.974^{-}
	flow --		31368.986^{-}	285202.696^{+}	2692.761^{-}	280796.471^{+}

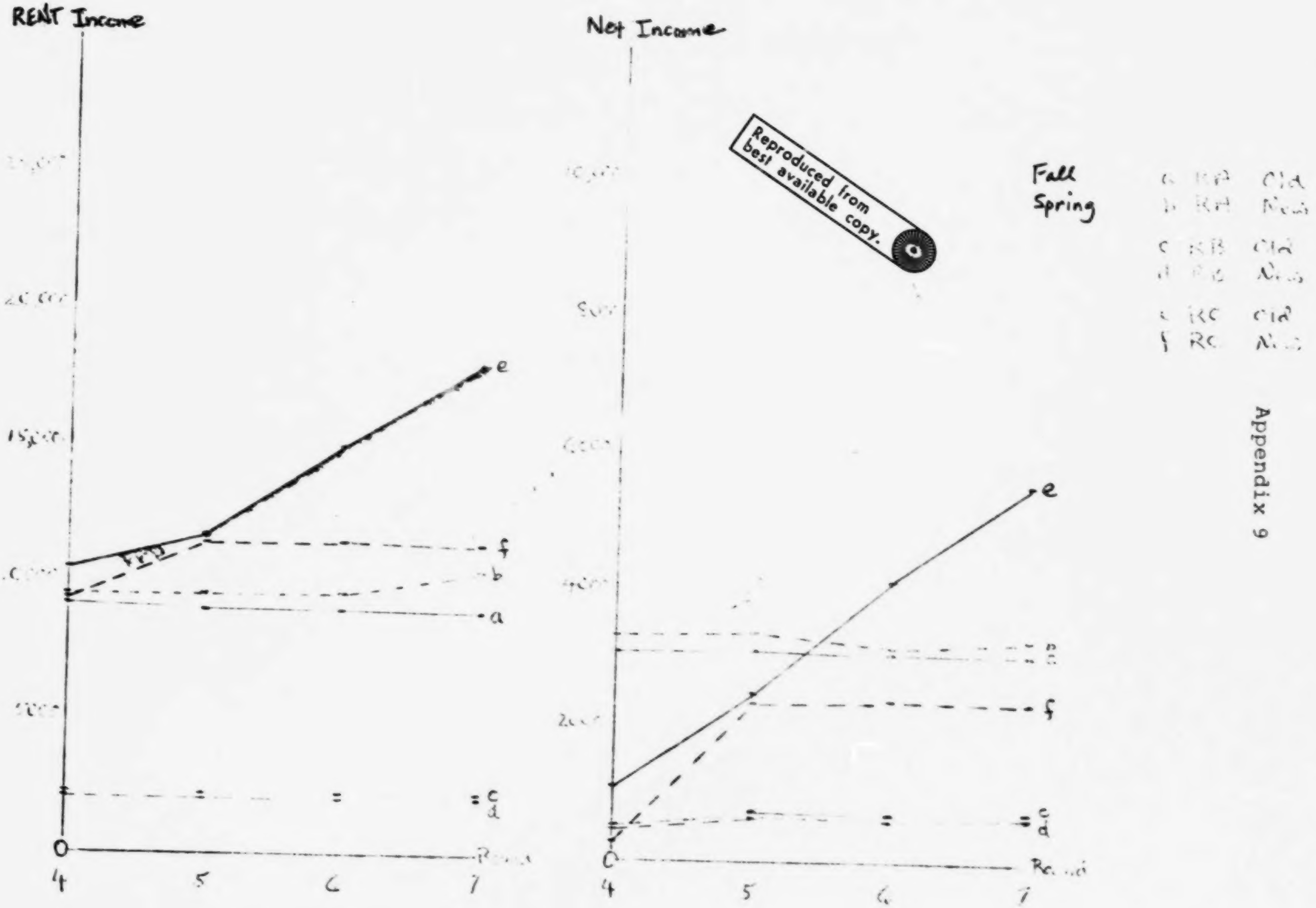
Round	Type#		Old Sales	Old Net Income	New Sales	New Net Income
6	RA	5	5064^{+}	1717^{+}	4876	1639^{-}
	RB	2	15936^{+}	5694^{-}	14681	5106^{-}
	RC	1	21480^{+}	7400^{+}	20288^{+}	6809^{-}
	C1	1	26400^{-}	1593.805^{-}	33500^{-}	2603.163^{-}
	flow	--	161462.778^{+}	319791.237^{+}	127559.36^{+}	293283.022^{+}
7	RA	5	5064	1892^{+}	4876	1656^{+}
	RB	2	15936	6485^{+}	14681	5183^{+}
	RC	1	21480^{-}	8339^{+}	20061^{-}	6836^{+}
	C1	1	159600^{+}	26054.795^{+}	109000^{+}	19496.555^{+}
	flow	--	-6106476.866^{-} 180000	-6731053.004^{-} 6138 593 354 100	158928.531^{+}	327355.585^{+}
				Economic G		
4	RA	6	7532	2553	7584	2609
	RB	2	7083	1778	7083	1810
	RC	1	10385	3452	10268	3424
	L1	1	230000	33426.912	109250	15764.344
	NS	1	97544.922	10799.071	83213.151	7116.908
	flow	--	170601.160	408560.065	158449.120	311106.025
5	RA	6	7532	2371^{-}	7584	2421^{-}
	RE	2	7083	2447^{+}	6972^{-}	1850^{+}
	RC	1	10385	2482^{-}	10385^{+}	2513^{-}
	L1	1	223098^{-}	34582.655^{+}	217409.001^{+}	32097.637^{+}
	NS	1	102409.050^{+}	11678.278^{+}	102409.050^{+}	11697.050^{+}
	flow	--	201243.528	433263.482^{+}	179155.634^{+}	419794.788^{+}
6	RA	6	8682	2981^{+}	8634^{+}	2980^{+}
	RB	2	7083	1840^{-}	9212^{+}	3120^{+}
	RC	1	20886^{+}	6997^{+}	20768^{+}	7015^{+}
	L1	1	225398^{+}	35718.855^{+}	225398^{+}	35949.923^{+}
	NS	1	104500^{+}	13989.136^{+}	104500^{+}	13387.148^{+}
	flow	--	258557.483^{+}	517847.718^{+}	241689.041^{+}	509261.208^{+}
7	RA	6	9710^{+}	3361^{+}	8682^{+}	3037^{+}
	RB	2	8107^{+}	2369^{+}	9212	3163^{+}
	RC	1	25064^{+}	9141^{+}	20302^{-}	6867^{-}
	L1	1	234598^{+}	41034.611^{+}	234598^{+}	39710.622^{+}
	NS	1	106589.050^{+}	14822.555^{+}	106589.050^{+}	13912.311^{+}
	flow	--	320654.016^{+}	590381.576^{+}	227446.425^{-}	509157.185^{-}

Round	Type	#	Old ('000s) Sales	Old ('000s) Net Income	New Sales	New Net Income
Totals			Sectors E, F, G			
4	RA	16	21030	7060	21582	7366
	RB	5	21624	6526	21517	6555
	RC	4	30897	7896	29850	6976
	H1	1	169289.1	23823.254	157815.061	19242.372
	PG	2	216628	21788.877	223640	24250.222
	C1	1	106100	20181.732	171100	34422.321
	L1	1	230000	33426.912	109250	15764.344
	NS	1	97544.922	10799.071	83213.151	7116.908
	flow --		401584.134	1113781.559	408461.268	1017817.493
5	RA	16	21303^{+}	7055^{-}	21979^{+}	6886^{-}
	RB	5	24124^{+}	8392^{+}	23786^{+}	7752^{+}
	RC	4	42234^{+}	11656^{+}	41915^{+}	11748^{+}
	H1	1	135174.735^{-}	9406.026^{-}	145776.675^{-}	13754.679^{-}
	PG	2	207766^{-}	-984.156^{-}	203426^{-}	-4790.257^{-}
	C1	1	48000^{-}	6178.974^{-}	48000^{-}	6178.974^{-}
	L1	1	223098^{-}	34582.655^{+}	217409.001^{+}	32097.637^{+}
	NS	1	102409.050^{+}	11678.278^{+}	102409.050^{+}	11697.050^{+}
	flow --		310855.626^{-}	1203466.686^{+}	309614.669^{-}	1191304.929^{+}
6	RA	16	22693^{+}	7735^{+}	23027^{+}	7792^{+}
	RB	5	25259^{+}	8287^{-}	26026^{+}	8932^{+}
	RC	4	57195^{+}	18478^{+}	52411^{+}	16197^{+}
	H1	1	162449.1^{+}	20389.803^{+}	138081.735^{-}	10776.012^{-}
	PG	2	148040^{-}	-18364.953^{-}	176970^{-}	-10886.014^{-}
	C1	1	26400^{-}	1593.805^{-}	33500^{-}	2603.163^{-}
	L1	1	225398^{+}	35718.855^{+}	225398^{+}	35949.923^{+}
	NS	1	104500^{+}	13989.136^{+}	104500^{+}	13387.148^{+}
	flow --		477635.818^{+}	1340219.291^{+}	473952.676^{+}	1310923.281^{+}
7	RA	16	23651^{+}	8276^{+}	23795^{+}	7922^{+}
	RB	5	26283^{+}	9613^{+}	26026	9065^{+}
	RC	4	64279^{+}	22979^{+}	51658^{-}	16074^{-}
	H1	1	171000^{+}	23529.124^{+}	159410^{+}	19911.809^{+}
	PG	2	108729^{-}	037017.736^{-}	166532^{-}	-29069.256^{-}
	C1	1	159600^{+}	26054.795^{+}	109000^{+}	19496.555^{+}
	L1	1	234598^{+}	41034.611^{+}	234598^{+}	39710.622^{+}
	NS	1	106589.050^{+}	14822.555^{+}	106589.050^{+}	13912.311^{+}
	flow --		548892^{+}	1398861^{+}		

TOTALS A, B, C, E, F, G

R	Type	#	Fall Old Sales	Net Income	Spring New Sales	Net Income
4	RA	30	34 467	10 614	35 550	11 161
	RB	10	44 287	11 770	44 211	11 797
	RC	6	65 821	19 403	64 488	18 627
	HI	2	313 184.835	38 450.283	317 699.211	38 665.852
	LI	2	247 135	3 777.592	166 405	13 402.524
	NS	2	203 088.972	20 179.366	188 757.201	18 086.957
	BS	1	103 400	6 678	118 580	9 079
	GB	1	421 520	30 891	414 260	29 405
	PS	2	92 035	-8 993	91 566	-9 237
	PG	2	216 628	21 788	223 640	24 250
	C1	1	106 100	20 182	171 100	34 422
flow --			666 744	1780 802	704 919	1716 346
R	RA	30	34 904	11 558	35 474	11 399
5	RB	11	51 286	14 991	50 961	14 496
	RC	6	77 158	24 230	76 953	24 465
	H1	2	275 297	21 320	295 971	28 610
	L1	2	274 076	29 884	268 387	27 466
	NS	2	204 818	24 240	204 818	24 277
	BS	1	170 100	-7 976	171 200	-3 462
	BG	1	41[illegible] 280	29 138	413 930	29 341
	PS	2	100 098	-18 500	99 556	-8 996
	PG	3	208 006	-13 784	203 666	-15 140
	C1	1	48 000	6 179	48 000	6 179
flow --			572 421	1959 783	624 774	2001 417
R	RA	31	38 439	13 191	38 973	13 123
6	RB	11	58 856	17 335	57 434	17 235
	RC	6	91 979	30 743	87 449	28 704
	H1	2	315 873	36 741	286 271	23 724
	L1	2	298 990	39 272	327 954	50 013
	NS	2	209 000	27 583	209 000	26 385
	BS	1	174 300	-6 275	182 700	1 179
	BG	1	423 500	30 333	427 020	31 723
	PS	2	111 143	-17 637	101 899	-36 342
	PG	3	248 237	-19 260	242 837	-15 508
	C1	1	26 400	1 594	33 500	2 603
flow --			662 750	2149 201	673 627	2121 083
7	RA	31	40 874	14 367	40 267	13 798
	RB	11	70 745	25 039	76 066	26 730
	RC	6	99 063	35 364	86 696	28 731
	H1	2	308 180	34 678	320 910	38 776
	L1	2	310 3[illegible]3	44 976	340 167	54 294
	NS	2	213 178	29 180	218 788	28 533
	BS	1	179 800	-4 051	202 180	7 915
	BG	1	462 660	34 566	455 840	34 609
	PS	2	113 946	-18 961	114 710	-52 097
	PG	3	242 091	-32 879	232 509	-56 968
	C1	1	159 600	26 055	109 000	19 497
flow --			754 090	2289 040	664 936	2291 500

Appendix 9



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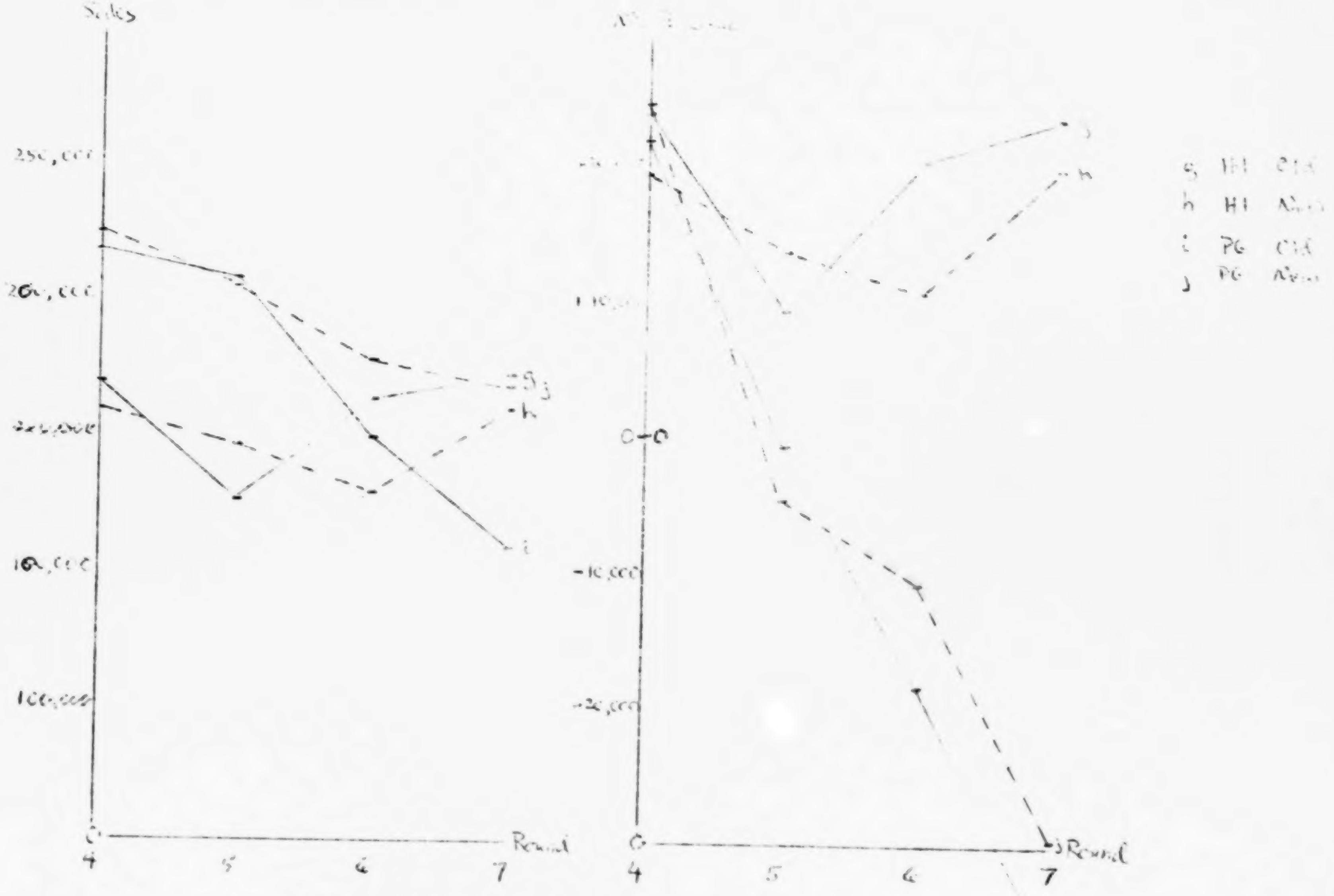
RESIDENCES - Economic Team E



BUSINESSES - ECONOMIC TEAM E

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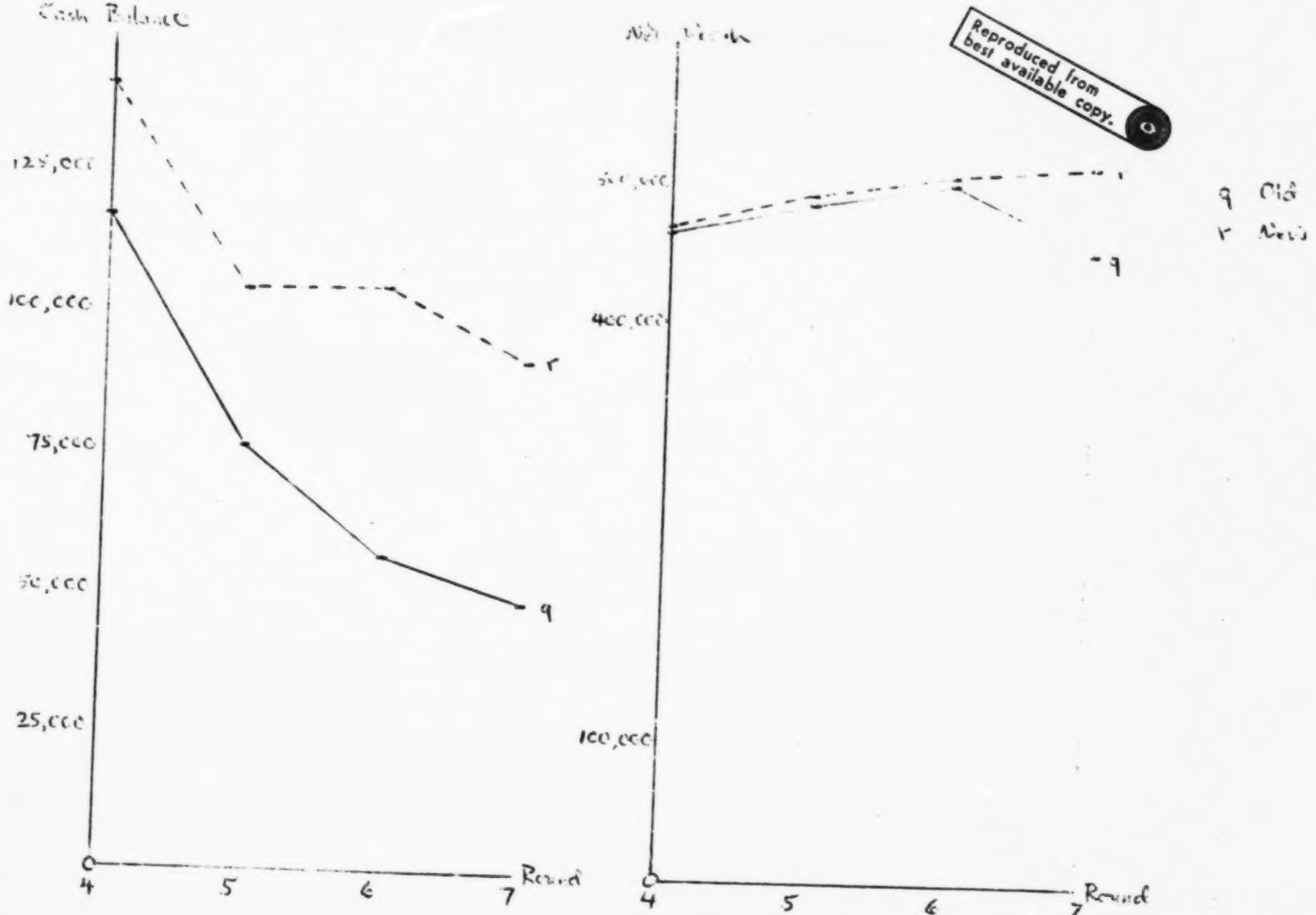
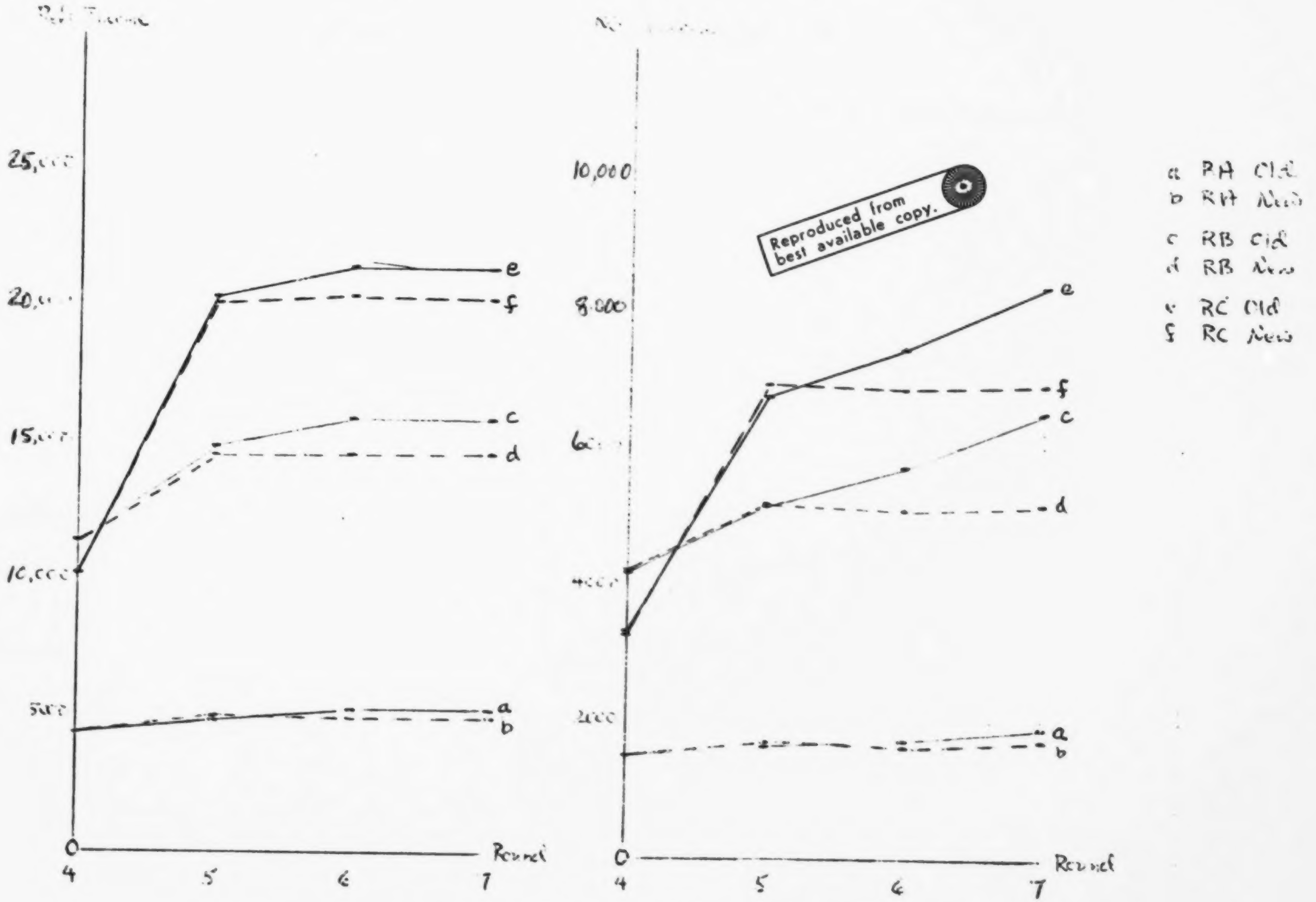


TOTAL FLOW - ECONOMIC TEAM E



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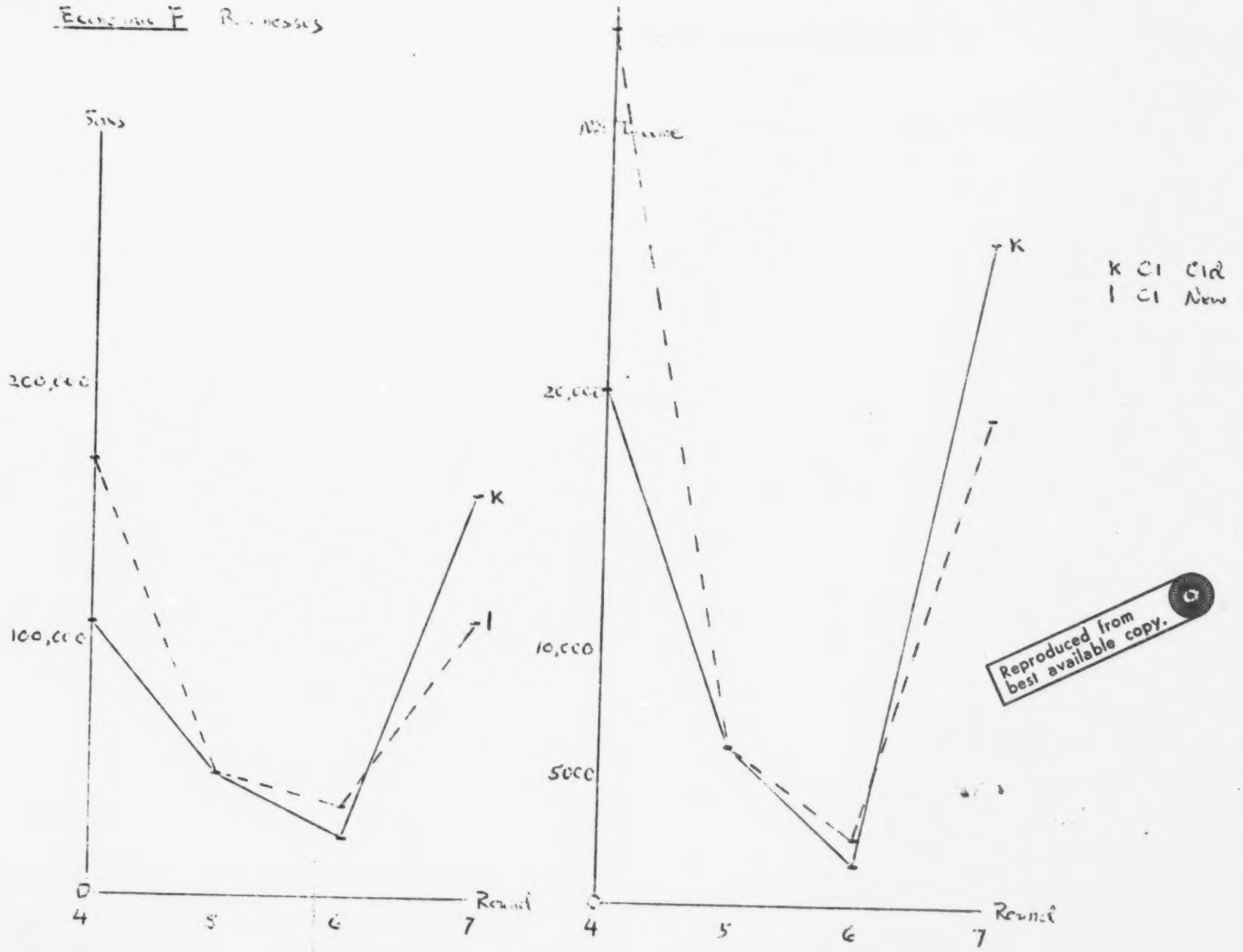
RESIDENCES - ECONOMIC TEAM F

Economic F Businesses



BUSINESSES - ECONOMIC TEAM F

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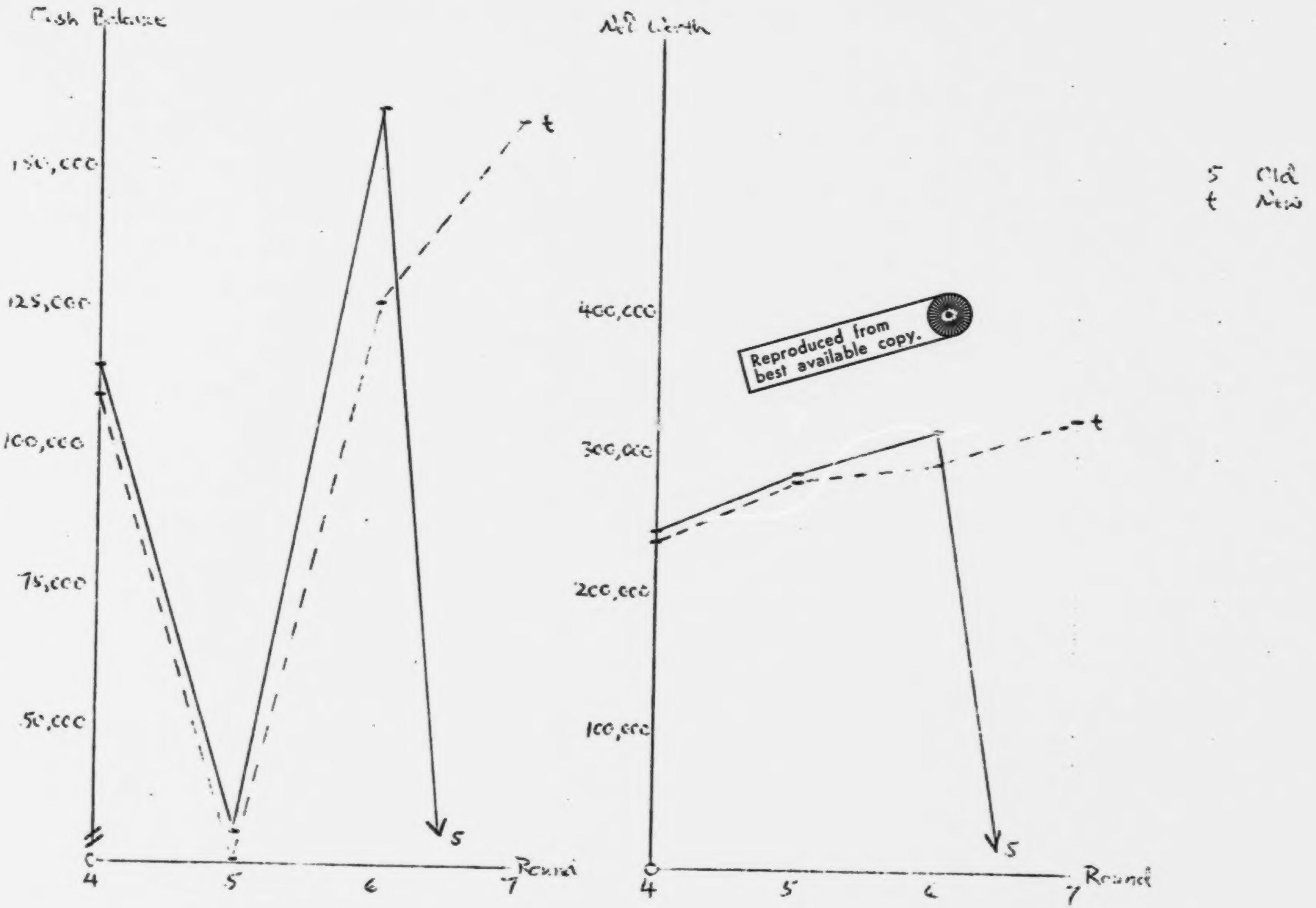

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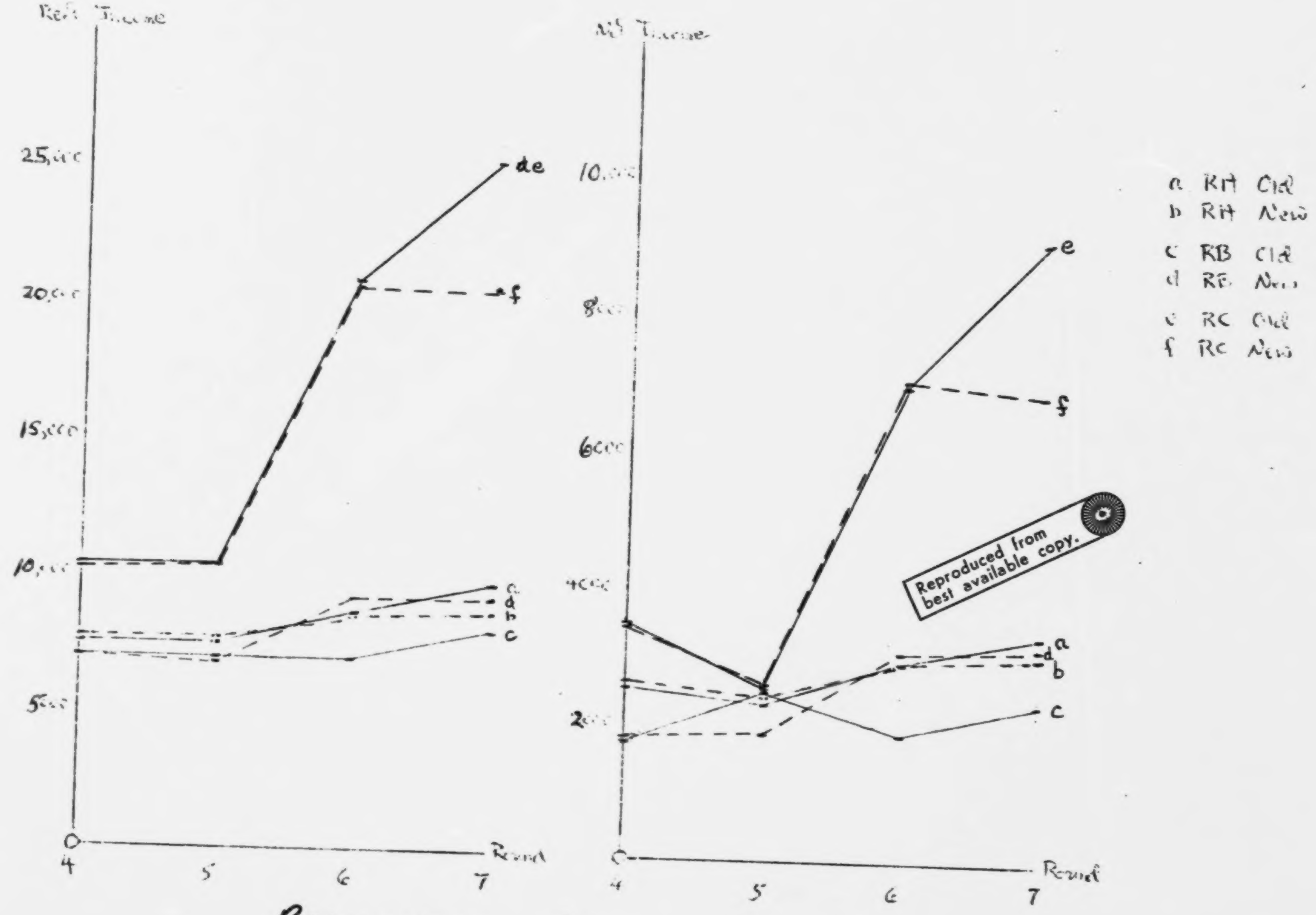
TOTAL FLOW - ECONOMIC TEAM F



RESIDENCES- ECONOMIC TEAM G

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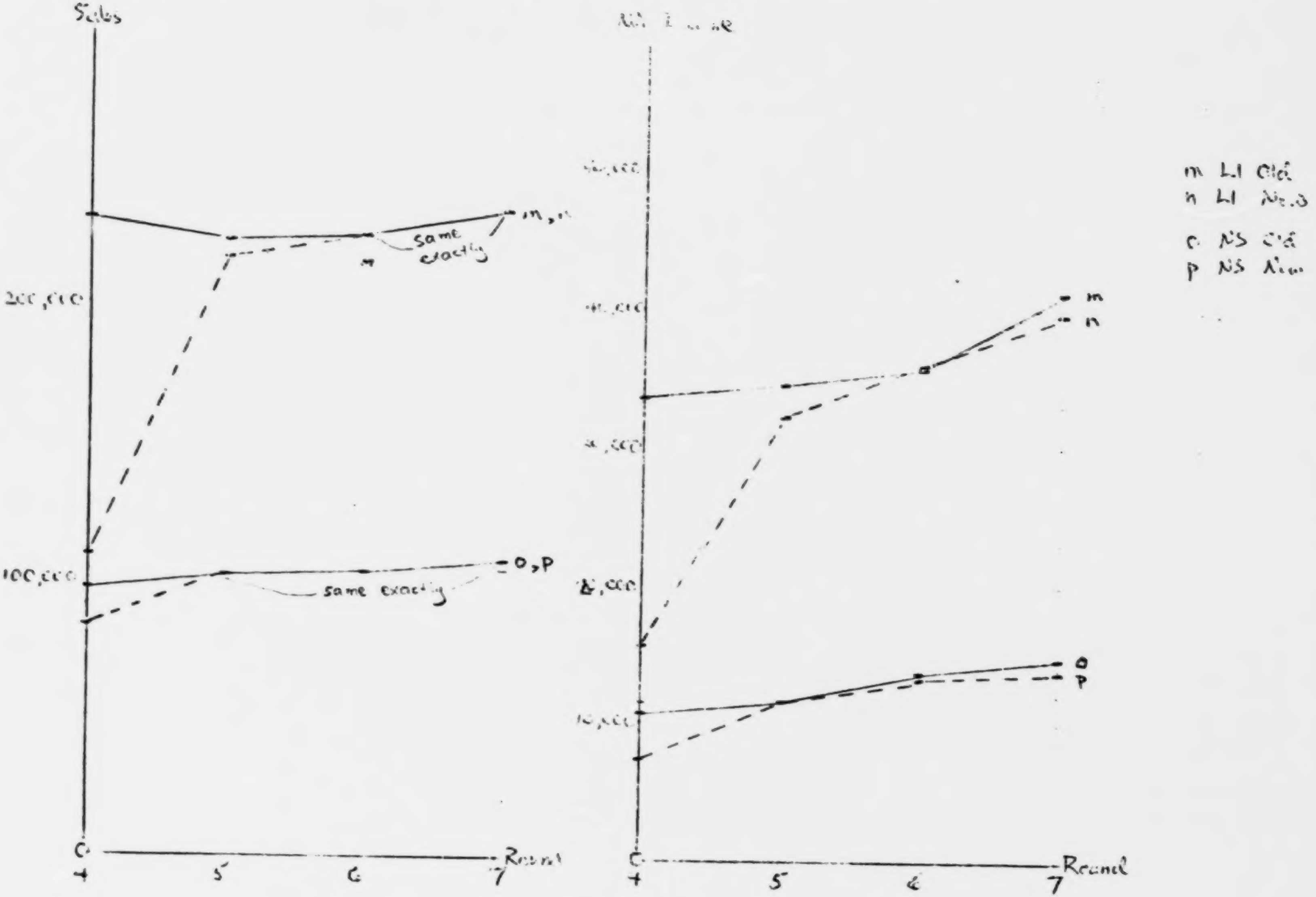
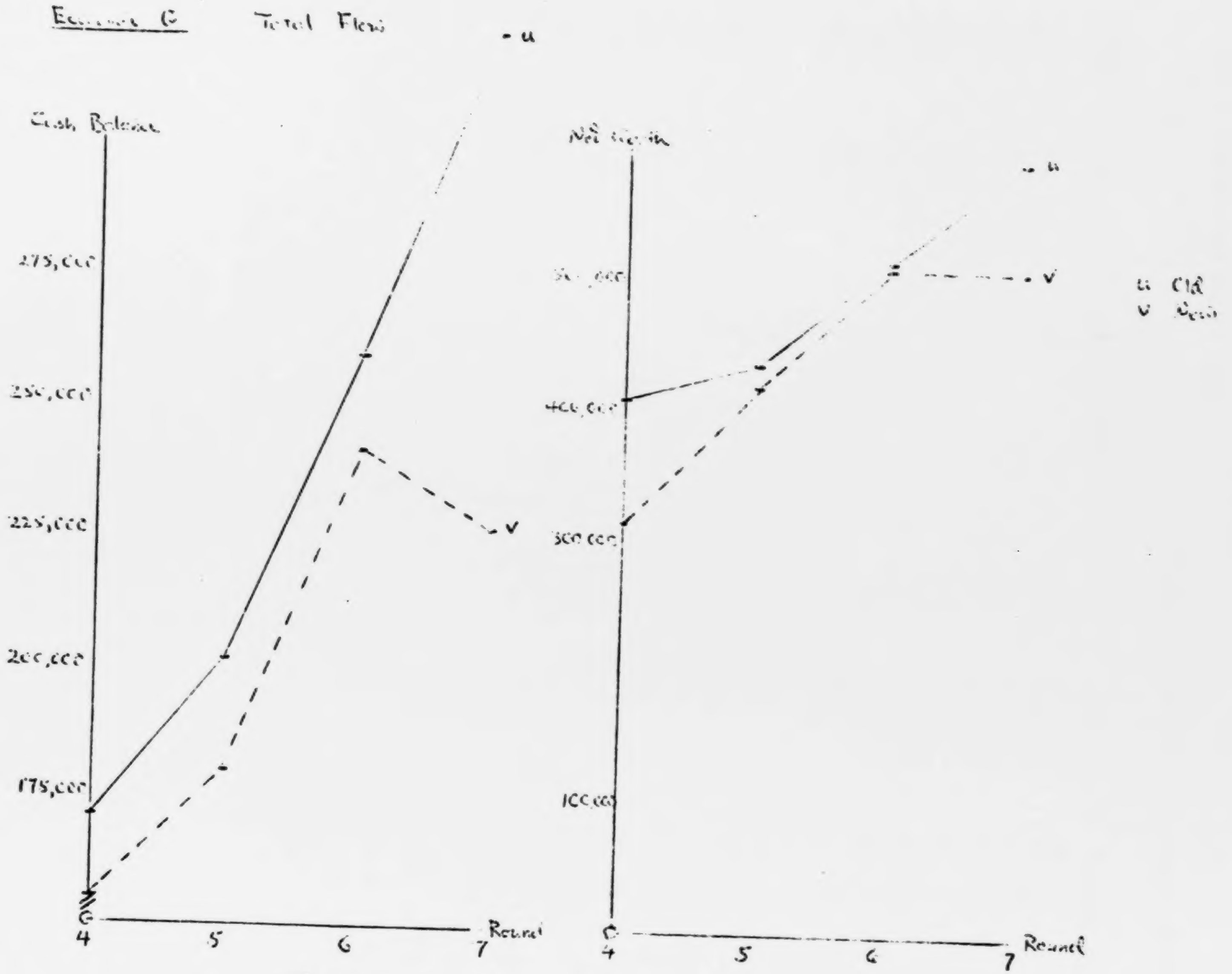


BUSINESSES - ECONOMIC TEAM G



TOTAL FLOW - ECONOMIC TEAM G

APPENDIX 10

City - wide Data A B C E F G

Profitability = (net income) ÷ (sales)

Round	Type	#	OLD	NEW	Round	#	OLD	NEW
4	RA	30	.308	.314	5	30	.331^{+}	.321^{+}
	RB	10	.266	.267		11	.292^{+}	.284^{+}
	RC	6	.295	.287		6	.314^{+}	.318^{+}
	H1	2	.123	.122		2	.077^{-}	.097^{-}
	L1	2	.015	.081		2	.109^{+}	.102^{+}
	NS	2	.099	.096		2	.118^{+}	.119^{+}
	BS	1	.065	.077		1	−.047^{-}	−.020^{-}
	BG	1	.073	.071		1	.071^{-}	.071
	PS	2	−.098	−.101		2	−.185^{-}	−.090^{+}
	PG	2	.101	.108		3	−.066^{-}	−.074^{-}
	C1	1	.190	.201		1	.129^{-}	.129^{-}
6	RA	31	.343^{+}	.337^{+}	7	31	.351^{+}	.343^{+}
	RB	11	.294^{+}	.300^{+}		11	.354^{+}	.351^{+}
	RC	6	.334^{+}	.328^{+}		6	.357^{+}	.331^{+}
	H1	2	.116^{+}	.083^{-}		2	.111^{-}	.121^{+}
	L1	2	.131^{+}	.152^{+}		2	.145^{+}	.160^{+}
	NS	2	.132^{+}	.128^{+}		2	.137^{+}	.130^{+}
	BS	1	−.036^{+}	.006^{+}		1	−.023^{+}	.039^{+}
	BG	1	.072^{+}	.074^{+}		1	.075^{+}	.076^{+}
	PS	2	−.159^{+}	−.357^{-}		2	−.166^{-}	−.454^{-}
	PG	3	−.078^{-}	−.064^{+}		3	−.136^{-}	−.245^{-}
	C1	1	.060^{-}	.078^{-}		1	.163^{+}	.179^{+}

Results (part 2)

Growth (percent)

Period	Net Worth		Cash Balance		City Popul
Rounds	OLD	NEW	OLD	NEW	OLD
4 - 5	10.05	16.61	-14.15	-11.37	11.39
5 - 6	9.67	5.98	15.78	7.82	11.20
6 - 7	6.51	8.03	13.78	- 1.29	6.42
4 - 7	28.54	33.51	13.10	- 5.67	31.83

Liquidity = (cash balance) ÷ (net worth)

Round	OLD	NEW
4	.374	.411
5	.292	.312
6	.308	.318
7	.329	.290

Preliminary correlations
([illegible])

```
900 DATA 4
910 DATA .308,.314,.331,.321,.343,.337,.351,.343

0.045 SEC.  2 1/2
READY

RUN

CORREL     29 MAY 71  15:15

THE CORRELATION COEFFICIENT =  0.952   RA

0.117 SEC.  15 1/2
READY

900 DATA 4
910 DATA .266,.267,.292,.284,.294,.3,.354,.351
RUN

CORREL     29 MAY 71  15:17

THE CORRELATION COEFFICIENT =  0.987   RB

0.110 SEC.  15 1/2
READY

900 DATA 4
910 DATA .295,.287,.314,.318,.334,.328,.357,.331
RUN

CORREL     29 MAY 71  15:18

THE CORRELATION COEFFICIENT =  0.894   RC

0.107 SEC.  15 1/2
READY

900 DATA 4
910 DATA .123,.122,.077,.097,.116,.083,.111,.121
RUN

CORREL     29 MAY 71  15:19

THE CORRELATION COEFFICIENT =  0.324   HI

0.108 SEC.  15 1/2
READY

900 DATA 4
910 DATA .015,.081,.109,.102,.131,.152,.145,.16,
RUN

CORREL     29 MAY 71  15:21

THE CORRELATION COEFFICIENT =  0.882   Li

0.104 SEC.  15 1/2
READY
```

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```
 10 DATA .099,.096,.118,.119,.132,.128,.137,.13
 UN

CORREL    29 MAY 71  15:23

THE CORRELATION COEFFICIENT =  0.983    NS

0.112 SEC.  15 I/O
READY

910 DATA .065,.077,-.047,-.02,-.036,.006,-.023,.039
RUN

CORREL    29 MAY 71  15:24

THE CORRELATION COEFFICIENT =  0.913    BS

0.114 SEC.  15 I/O
READY

910 DATA .073,.071,.071,.071,.072,.074,.075,.076
RUN

CORREL    29 MAY 71  15:28

THE CORRELATION COEFFICIENT =  0.717    BG

0.108 SEC.  15 I/O
READY

910 DATA -.098,-.101,-.185,-.09,-.159,-.357,-.166,-.454
RUN

CORREL    29 MAY 71  15:30

THE CORRELATION COEFFICIENT =  0.308    PS

0.109 SEC.  15 I/O
READY

910 DATA .101,.108,-.066,-.074,-.078,-.064,-.136,-.245
RUN

CORREL    29 MAY 71  15:31

THE CORRELATION COEFFICIENT =  0.949    PG

0.112 SEC.  15 I/O
READY

910 DATA .19,.201,.129,.129,.06,.078,.163,.179
RUN

CORREL    29 MAY 71  15:32

THE CORRELATION COEFFICIENT =  0.99    C1

0.117 SEC.  15 I/O
READY
```

```
900 DATA 3                                          Growth Correlations
910 DATA 10.05,16.61,9.67,5.98,6.51,8.03
RUN                                                    (OLD vs. NEW)

CORREL     29 MAY 71   15:35

THE CORRELATION COEFFICIENT =  0.425    Δ Net worth

0.112 SEC.  15 I/O
READY

910 DATA -14.15,-11.37,15.78,7.82,13.78,-1.29
RUN

CORREL     29 MAY 71   15:36

THE CORRELATION COEFFICIENT =  0.907     Δ Cash balance

0.107 SEC.  15 I/O
READY

910 DATA 11.39,10.75,11.2,11.11,6.42,7.97
RUN

CORREL     29 MAY 71   15:37

THE CORRELATION COEFFICIENT =  0.99      Δ Population

0.110 SEC.  15 I/O
READY

900 DATA 4
910 DATA .374,.411,.292,.312,.308,.318,.329,.291 Liquidity Correlation
RUN
                                                        (OLD vs NEW)
CORREL     29 MAY 71   15:39

THE CORRELATION COEFFICIENT =  0.805    rounds 4,5,6,7

0.104 SEC.  15 I/O
READY


900 DATA 3
910 DATA .374,.411,.292,.312,.308,.318
RUN

CORREL     29 MAY 71   15:40

THE CORRELATION COEFFICIENT =  0.991    rounds 4,5,6

0.109 SEC.  15 I/O
READY
```

```
900 DATA 3                                   Cross Correlations
910 DATA 10.05,11.39,9.67,11.2,6.51,6.42
RUN

CØRREL     29 MAY 71   15:43

THE CØRRELATIØN CØEFFICIENT =  0.998    Δ Net Worth vs. Δ Population, CLD

0.117 SEC.  15 I/Ø
READY

910 DATA 16.61,10.75,5.98,11.11,8.03,7.97
RUN

CØRREL     29 MAY 71   15:44

THE CØRRELATIØN CØEFFICIENT =  0.234    Δ Net Worth vs. Δ Population, NEIC

0.117 SEC.  15 I/Ø
READY

1←910 DATA 10.05,-14.15,9.67,15.78,6.51,13.78
RUN

CØRREL     29 MAY 71   15:49

THE CØRRELATIØN CØEFFICIENT = -0.533    Δ Net Worth vs. Δ Cash Balance, CLD

0.115 SEC.  15 I/Ø
READY

910 DATA 16.61,-11.37,5.98,7.82,8.03,-1.29
RUN

CØRREL     29 MAY 71   15:51

THE CØRRELATIØN CØEFFICIENT = -0.952   Δ Net Worth vs. Δ Cash Balance,
                                                                  NEIC
0.107 SEC.  15 I/Ø
READY
```

Chapter VII

CITY MODEL USAGE FOR COURSES IN REAL ESTATE AND URBAN DEVELOPMENT PLANNING

by

Maury Seldin
Professor and Director
Urban Development Studies
The American University

CITY MODEL USAGE FOR COURSES IN REAL ESTATE AND URBAN DEVELOPMENT PLANNING

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CITY MODEL USAGE FOR COURSES IN REAL ESTATE AND URBAN DEVELOPMENT PLANNING

by

Maury Seldin
Professor and Director
Urban Development Studies
The American University*

BACKGROUND AND DEVELOPMENT

Instructor

Use of model. The instructor's first experience with gaming was with CLUG in the fall of 1967, when he taught a capstone course for real estate majors in the School of Business Administration of The American University, entitled "Seminar in Real Estate Administration." The purpose of this integrating seminar was to provide the student with an opportunity to bring to bear the substantive knowledge from various courses in the solution of problems the student would be expected to face as a decision-maker.

CLUG, a manually operated Game, was comparatively simple in contrast with the computerized models such as City I and City II. Initially, the emphasis was upon

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* The author wishes to acknowledge the assistance of Robert P. Jones in the preparation of the last section of this paper.

analyses useful in investment decisions, for example, market analyses, valuations, and forecasts of city growth and structure.

The course next used the game "Region" which was invented during the 1967-1968 school year. "Region" handled more variables and permitted greater emphasis on analyses of local economic structure and the administration of economic environment.

One of the doctoral students playing the Game was able to clearly identify a complex set of relationships structured in the Model and tie them to the existing literature. In general, the students were able to see how the principles they had been taught were applied to real world situations, or at least to a simulation of those situations.

The students in that graduate class found the urban environment mismanaged and impeding the achievement of their objectives. To meet the problem, they applied to the public sector entrepreneurial talents previously used in the private sector. The result was a more favorable environment for their private interests and better performance by the public sector.

Based on favorable experience in graduate classes, the Game "Region" was introducted into a capstone undergraduate course. The level of undergraduate student sophistication was substantially different. These students had a high interest in the Game but their lack of professional competence, as compared to the graduate students, was evident. The knowledge they had supposedly acquired did not come into play when they had opportunities to apply it. The undergraduates needed close instruction on the application of principles as demonstrated by the Game. The approach taken was to assign individual projects to each student which called for the analyses necessary to solve a Game problem. Thus, the student had more than an academic reason for learning or relearning a facet of the body of knowledge or the analytical technique.

The following year (1968) the graduate course used the City I Model. The next year (1969) a graduate course used the City II Model. (City I was used for an undergraduate class in the Spring of 1970.) The substance of this Chapter will be a description of the use of the City Model, with emphasis on the experience of the graduate class in the fall of 1970 and the undergraduate class in the spring of 1971.

Use of model in research. One of the great side benefits of teaching is that the instructor learns as he teaches. The old adage "If you want to learn a course, teach it," proved to be true.

At first, the approach to instruction was to let the student get the joy of discovery as he played the model. The student would learn principles from the Game only to discover that he had previously learned them in a different form. The process taught well but slowly. In order to speed up the process, the instructor explained the model and principles early in the semester. While the mass of explanation was more than could be readily digested, it did permit the students to push deeper than they otherwise could have. As a result, questions were asked on matters not previously covered in the course. These questions turned out to be of the same nature as those the instructor was concerned with in his research. Indeed, the instructor first intended to use the Game in connection with an approach to a research problem.

Many students attempted to conceptualize the relationships brought to light by the events in the Game. They could then use their understanding of these relationships in their decision-making processes. The real world decision-maker is in the same position, except that he frequently operates under the handicap of a lack of familiarity with the body of knowledge.

The major thrust of the instructor's research effort was to improve real estate and urban development decision-making on the part of real world decision-makers as well as aspiring students.

In this case the model served as a useful tool in handling complex abstractions with which the instructor had to deal. The models helped because they became progressively closer to reality, adding subsystems and providing greater detail in simulating the urban system. Thus, the instructor was able to conceptualize a process of managing the urban development system by conceptualizing the management of the subsystems and their coordination. A view of the problem of managing any subsystem had to be related to the total system. By successively working more complex models, the instructor-researcher was able to handle the more complex abstractions on an incremental basis. This provided the basis for conceptualization of a major research and demonstration project which is now under way.

That major research effort involves an approach to urban development planning which applies planning, programming, and budgeting principles to the urban development process. Of special importance are the criteria for balance in the system and methods of administration where the power to control the process is strong but fractionalized. This approach is further described in a paper entitled "Location of Residential Development."[1]

A major output of this approach is information in a form usable to decision-makers. The approach relies substantially on the power of information as it may be used to influence decision-makers and on the use of information in the political process.

The research on which the instructor is currently engaged is in the design of this system on a pilot basis for Fairfax County, Virginia. An operational system in the Game or in the real world, or both, would provide a useful teaching device not only for university students but for those who are making the decisions in the public and private sector.

Professional background. A set of value judgments or biases may have been visible in the previous discussion. The value system is one which holds that the use of a market mechanism is desirable as a basic approach to economic problems. While not the sole approach, it utilizes the pursuit of self-interest to achieve community objectives. (It recognizes the important role of government in providing an environment in which a private sector can operate. It further recognizes the role of government in supplementing such activities where the results are found wanting. In addition, it recognizes the use of alternative means where the market is not workable for various reasons.) While this is no place to expound various philosophical views, the aforementioned information will be helpful to the reader in understanding the assumptions which underlie the normative economic analysis and hence the approach to business and government decision-making.

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[1] Maury Seldin, "Location of Residential Development," *Papers Submitted to Subcommittee on Housing Panels on Housing Production, Housing Demands, and Developing a Suitable Living Environment*, Part I. Committee on Banking and Currency, 92nd Congress, First Session. U.S. Government Printing Office, June, 1971, pp. 243-262.

The instructor received his formal education in business administration. He has Bachelor of Science and Master of Business Administration degrees from the University of California, Los Angeles, with majors in real estate and urban land economics. His doctoral degree is from Indiana University, School of Business Administration, in the fields of real estate administration, business-government relations, finance, money and banking, and applied economic analysis. His dissertation for the degree of Doctor of Business Administration was entitled "An Analysis of the Impact of the Firm on Urban Plant Problems." That dissertation, completed in 1960, explored the thesis that business firms in pursuing their objectives may incidentally lessen community problems through solving their own problems.

The professional mission of improving the quality of real estate and urban development decisions has led to a heavy emphasis on research concerned with improving institutional arrangements for the functioning of a free society. The particular institutional arrangements under scrutiny are those directed toward guiding market forces so that individuals pursuing their own objectives will tend to contribute toward the community's achievement of its objectives.

Specific research by the author in the public sector areas includes the urban development information system now being developed in Fairfax County, Virginia; a recently completed demonstration project on a uniform building permit system for the Washington metropolitan area, which system would provide a data base for the aforementioned systemic approach to urban development management; also a recently completed study of the impact of the construction moratorium on the Washington metropolitan area. Other current or recent consulting includes services rendered to the Subcommittee on Housing of the House Banking and Currency Committee, and to the Office of Management and Budget, Executive Office of the President, as well as to local planning and government authorities. In the private sector, his work includes consulting for developers and coauthorship of a recent book entitled Real Estate Investment Strategy.

Professional association activities dealing with these problems include service as Vice President and 1970 Program Chairman for the American Real Estate and Urban Economics Association (the theme for the program having been: "Meeting Housing Needs.") Other community services such as being President of the George Washington Chapter of Lambda Alpha membership on the Urban and Regional Affairs Committee of the U.S. Chamber of Commerce, indicate a sustained effort to bridge the gap between academia and real world decision-makers. The concern is to keep in touch with what is happening and to assist in educating those who are or will be decision-makers, especially by aiding them to understand how the system operates and how it may be improved.

The general objective includes increasing the effectiveness with which we use our resources, especially land. The improved management of our land resources is viewed as a significant aid to the improvement of the management of the other resources.

Course Development

The real estate curriculum at The American University came into existence some twenty years ago. It started with a Real Estate Law course transferred from the Sociology Department at a time when there did not seem to be much interest in real estate and urban development. Over the next fifteen years a series of courses were developed which emphasized private sector decision-making. The sixteen real estate and urban development courses offered in 1965 for graduates and undergraduates revealed this emphasis. The capstone course, an integrating Seminar in Real Estate Administration, was added in 1965. It used case material in order to give the students an opportunity to integrate the substantive knowledge acquired in their various courses and apply this knowledge to decision-making situations.

The thrust of that course was the use of analysis in the administrative process, focussing on typical real estate decisions of valuation, market analysis, location studies, particularly in the context of an administrative problem.

When CLUG was introduced in the Seminar in 1967, it was possible to use the simplified model as a basis for conducting market analyses. In the Game, the data were readily available and so the student could concentrate on methodology rather than on the time-consuming and difficult problems of gathering data. This was of significant assistance in teaching because data are not generally available for all the various kinds of analyses useful to demonstrate an understanding of the body of knowledge. "Region" provided a more realistic model and the City models were substantial improvements in the stimulation of the environment in which the decisions were being made.

As the Games were being developed, so too was the course. The emphasis changed from market analysis, valuation, location studies and the like, to analyses relating to the management of the real estate resource.

One of the great merits inherent in the study of real estate is that the resource has such distinguishing characteristics that the analysis brings into focus principles which might otherwise be clouded. Thus, the application of planning, programming and budgeting techniques to the administration of real estate development enterprise illustrates the principles of balance necessary to get from here to there. These same principles apply for the urban development process. The Game is a useful device for explaining these relationships as they apply to both business management and land use management. Once the principles of land use management are understood, the management of the urban development process may be more readily grasped.

The Seminar integrates not only the real estate decision-making from the firm-investor point of view, but also urban land decision-making knowledge from a community point of view. The relationship between the two is also subject matter for the course. While the title "Seminar in Real Estate Administration" thus has become a misnomer, the course continues to emphasize the real estate resources, albeit in a context of urban problems as well as business problems. Considerable attention is also given to the relationship between the two. While management of the urban system is considered mainly in terms of an environment in which to do business, public administrators would also find it useful in their work.

The undergraduate course entitled "Real Estate Administration" in which the Game has been used is likewise a capstone course for the undergraduate real estate major. Initially, the Game did not work as well in this course because the students did not have sufficient substantive knowledge to integrate at the level of sophistication intended for the course. Attempts to shore up this deficiency have been made first by directing the student to conduct specific kinds of analyses with specific references to the literature. This has worked reasonably well in that the students who have a reason for wanting to understand a particular type of analysis do a good job in pursuing the knowledge. However, it has been necessary to transform the procedure into one in which more readings are programmed into the course as the Game progresses. The literature has not been designed for this purpose, and so the progress, while adequate, still leaves much room for further development.

Because of curriculum changes at the undergraduate level, a new course in urban development is to be offered in the fall of 1971 in which the Game will be utilized as a way of introducing the student to the body of knowledge. The old capstone course will go by the wayside and a new course focussing on investment decisions will take its place. The elementary course which is intended for undergraduate students of various majors in business administration focusses on the urban development process. It is anticipated that it will include the set of readings closely tied to the Game which is used as a stimulus to the student pursuing the knowledge necessary to improve his decision-making.

The differences in approach are related to the differences in student profile. On the one hand the graduate students are expected to be able to run a city efficiently and to do a good job of administering the resources which they control in the private and public sectors. At the undergraduate level, on the other hand, students are exposed to a body of knowledge whose purpose is to give them a liberal education rather than professional competency.

THE COURSE

Course Objectives

The purpose of the course is to improve the quality of real estate and urban development decision-making through the use of a body of knowledge. This objective is sought through the education of students who are or may become the decision-makers. The course is designed to give them an opportunity to conduct the analysis which leads to the decisions and to see the consequences of those decisions and subsequent actions. This gaming approach is different from the term project approach in that in the Game they make the decisions and have the opportunity to implement them. They receive a feedback from their actions. In addition, other forces are constantly at work which alter the effectiveness of their programs for achieving the objective they set forth. They therefore have a learning experience in how to deal with a changing environment. The round-by-round play gives them the feedback so they get significant experience in selecting the type of analysis which is necessary to move them toward their objectives. The allocation of their time as well as of their Game resources is a critical determinant of the success they hope to achieve.

The course is designed to enable them to improve their analytical ability. It starts out geared to the developer-investor and others who are primarily concerned with individual parcels of real estate. But as the course develops, it is obvious that these decisions must be looked at in terms of what the rest of society is doing.

The resultant administrative process integrates decision-making through the various disciplines. As the Game progresses the students see that they are at sufferance of the environment in which business needs to perform its functions. They increase their involvement in the management of that environment. They apply the same administrative processes to the management of that environment. They then learn more about the relationship between business and society.

The types of analyses at the micro-level include market analysis for shopping centers which are simulated by "personal goods" and "personal service" industries. Other market analyses are used for various types of property to be developed. Appraisals need to be made for various purposes. Business and property analyses are made in order to improve profitability of the enterprises. Investment portfolio analyses are conducted. In a sense, the economic teams manage a variety of business enterprises and a portfolio of real estate resources. Unfortunately the income to business and the income to the real estate are not separated. But, the student is able to explore the application of principles which he has learned in his real estate and business administration courses. He also finds that human relations and leadership qualities become important determinants of his success.

At the macro-level the objective is to improve the student's understanding of how the system works. He does this by assuming a public role in which he does the planning and zoning or provides the transportation facilities or utilities, or he may be mayor and coordinate public sector efforts. The Game is so devised as to provide the feedback which can be used as a measure of the quality of performance of these various public sector functions. The student then sees how the proper (effective?) functioning of government influences the proper (effective?) functioning of business, or perhaps more correctly how the improper (ineffective?) functioning of government adversely influences the proper (effective?) functioning of business.

Since the public and private interests become interwoven, the Game provides a good way of demonstrating decision-making in a society in which there is some community of interest between the public and the private. The class determines its own standards of morality. A system of ethics and law develops in a way that enables the society to function. The set of values varies with the student group, but whatever the values, they show through in the operation of the Game.

The operation of the public sector provides significant opportunities to apply analytical techniques for public decisions in much the same way analytical techniques can be used for profit-oriented decisions.

For example, a school location decision is not so different from a shopping center location decison. Experience in the Game shows that the private sector decision-makers do use that knowledge of analytical techniques for public sector decisions.

The public sector demonstrates a need for balance in the system. The balance is not only in the provision of public facilities but also in the private development of the appropriate mix of land uses.

One of the great lessons of the Game and of the course is that the urban development process may be managed by providing an environment in which the private decision-makers pursuing their own objectives respond to public sector objectives. They build where the facilities are available and at the best place to serve the markets. Since the public sector can control the locations where the facilities become available, there is an opportunity to be socially and politically, as well as economically responsive. An efficient system can be developed by developing balance.

The inefficiencies become expensive not only to the developers but to the community as a whole, so it becomes evident that it pays to have an improved analysis of the problems of managing the environment in order to achieve public objectives, whatever they may be.

In City II the public objective decision-making is complicated by the presence of a separate social sector which is generally muted in the classes under discussion. Some development may take place in activating this sector. But the social sector receives little attention because of the small size of the class and the entrepreneurial tendencies of the students generally, as well as because of the selection of students.

Course Structure

One view of how best to educate a student is to let him work with a professor for several years on a one-to-one basis. This will permit guidance of his activities in reading, writing, and solving problems, real or simulated. The feedback permits close attention to individual needs. The platitudes offered at commencement time have some merit. Formal education has really just begun. Education before the degree should provide experience, knowledge and understanding that will continue to grow after graduation.

The reason for not operating a university on a one-to-one basis is that it is far too expensive. The alternative is to put students in groups and perhaps into classes and organized curricula so that a body of knowledge may be transmitted. Universities today may be "so well organized" that the student-teacher relationship has gone by the wayside in the sense of the student going to study under someone. This is less true at the graduate level than at the undergraduate level, but the problem is the same.

The Game provides an opportunity for the professor to work with each and every student on the individual students' unique problems. And while the students are grouped together in a class and live in this simulated society which, for them, is very real, they are also able to pursue their educational experience on an individual basis. Many students are uncertain about why they want to acquire the body of knowledge. Some of them will simply proceed on faith that it is really advantageous to study the discipline. The Gaming decision puts them in a situation where they know why they need to know. They are then receptive to the opportunity to seek out that understanding. And while the courses are taught with lectures explaining parts of a body of knowledge and reading material that is helpful, there is a high degree of contact in class between students and faculty and indeed among students who go on to learn from each other.

The case study approach is a halfway measure in this process. It provides a student with the opportunity to simulate situations and to discuss them. They get involved in someone else's problem. They really don't get the feedback. In the Game they are involved in their own problem. They get the feedback.

Typically, at the beginning of the semester the student writes a one-page paper outlining his goals and objectives. He then programs his activities in order to achieve his objectives. The Game provides a situation in which he may be measured against the standards he sets.

Over the past few years the instructor has experimented with various mixes of Games and other techniques. These range from building the entire course around the Game to programming the Game for one half of the course and projects for the other half. When the course was in essence all Game, the students would write many papers demonstrating how they conducted their analyses, showing detailed plans of what they were going to do, and the like. The middle ground includes a heavy lecture schedule and the use of the Game to illustrate specific points. The minimal use of the Game occurred when term papers were assigned separately from the Game. This meant there were very few of the short papers in the Game, but a heavy assignment on the project. The discussion made use of the Game for the Model.

The instructor's preference depends on the objectives in view. When the purpose is to teach analytical techniques, many short papers work out best. When the goal is to develop a professional competence in some particular dimension, the term paper works well when the Game is used as a frame of reference. When the idea is to convey a general understanding of the urban system and decision-making within it, the best combination consists of the Game plus the reading and some modest papers.

DYNAMICS

Familiarization with the Model

The student is introduced to the Model through the use of a film, lectures, and the City Manual. The film shows the excerpts of a previous play of the Game and gives a brief narration of what to expect. This film is supplemented by lectures which emphasize acquiring knowledge and applying various tools of analysis in order to improve decision-making. Also, the students are requested to read the City Manual to familiarize themselves with its extensive technical contents.

The technical nature of City II makes an understanding of the urban system depend upon a working knowledge of this particular Model. After the completion of one or two rounds, supplemented with staff assistance as to the operation and certain basic relationships, the majority of the students are questioned (and invited to ask questions) on how the urban system operates. The purpose of this session is to give each individual player a broader conception of his role and the roles of other players in the system. The subsequent sessions provide repeat opportunities to increase familiarity with the operation of the Model and the real urban system.

Trend of Play

Armed with the technical knowledge and a simplistic view of the urban environment, the student is encouraged to develop an administrative approach utilizing the framework implicit in the planning-programming-budgeting systems approach. The student is expected to:

1. Define his general GOAL which is OUTPUT ORIENTED,
2. Identify OBJECTIVES which indicate conditions or levels which must be obtained or maintained to successfully reach the designated GOAL,
3. Draft PROGRAMS which are designed to achieve the standards set by the various OBJECTIVES.

4. EVALUATE THE PROGRAMS to determine their effectiveness (in cost/benefit terms) as compared to alternative programs.

As an example, one student's interpretation of his political role in the urban system is abstracted as follows:

> POLITICAL GOAL School Department
>
> Develop a school system comparable to the best in the nation, which will provide high quality, accessible and meaningful educational experience to the people of Blue City.
>
> OBJECTIVE #1
>
> Maintain the pupil/teacher ratio at less than 15/1.
>
> > Program #1
> >
> > Using population growth projections, determine future student levels. Hire middle and high income teachers, at the optimum mix, to meet this demand.
> >
> > Program #2
> >
> > Redistrict school boundaries to better utilize existing resources.

Program #3

Construct new schools or add to existing facilities as projected. (Specific round-by-round projections are used.)

OBJECTIVE #2

Keep unmet demand for adult education at less than 10% of the total demand.

Program #1

Similar to those for OBJECTIVE #1.

It can be seen from this example that the School Department has:

1. A definite goal (to be the best)
2. Identified meaningful standards of performance (student/teacher ratio of 15/1 and unmet demand for adults at 10% or less)
3. Determined approaches to achieve these standards (population projections, new construction, redistricting, etc.)

Some of the various types of analyses which were employ by a number of the decision-makers as described in the discus which follows indicate that most analyses performed fall under the Program category.

Economic base. Fundamental to many papers which analyzed Blue City for various reasons was the determination of wny the city is growing. The recommended readings in Wilbur Thompson's Preface to Urban Economics had drawn attention to "export base" theory and the students were able to identify the following components of the economic base of Blue City.

SALES TO THE NATIONAL ECONOMY

(in millions)

INDUSTRY	YEAR 1	3	5	7
LI	$203	$233	$223	$234
HI	$470	$528	$530	$503
NS	$208	$215	$323	$526
	$881	$976	$1,076	$1,263

This is a useful exercise but its impact on decision-making is minimal unless it is used in conjunction with the other data.

Business cycle. Export base analysis, since it is dependent upon sales of goods and services outside the local economy, must be supplemented by an analysis of the condition of the national economy. This provides a useful yardstick for measuring economic performance. By charting the prices paid for basic industry output, the return on investments and the interest rate on loans and bonds, the students were able to determine which phase of the business cycle they were in. Most correctly identified the downtrend of the recession. This may have been one reason for the general hesitation of investors to make large capital investments in Blue City.

Demographic analysis. Other basic studies, important to public and private decision-makers, concerned the tracing of population growth and projecting future levels. Other trends that were investigated included: employment (total), employment distribution by industry, unemployment rates and income distribution. All these data were readily available and in a usable form but it was concealed among mountains of other figures. Here again the PPBS format guided the student to assemble only the pertinent facts and disregard peripheral information.

Housing market analysis. Another basic tool of the decision-makers of Blue City, important in any geographic area where dwelling units are in competition with one another as alternatives for the users of housing, was the housing market analysis. It incorporates many of the previously mentioned types of analyses: economic base, employment trends, income distribution and population analysis. An additional component of a housing market analysis is the housing stock or inventory. The magnitude of the total housing stock in terms of dwelling units, reflecting changes over time, is one of the most significant items of the reported data. In the example cited below the student goes one step further by identifying the change in distribution of the inventory by structural type.

HOUSING INVENTORY
(level of development)

TYPE OF DWELLING	YEAR		
	1	4	7 (current)
Single Family (RA)	101	115	123
Garden Apt. (RB)	24	31	37
Hi-Rise Apt. (RC)	6	6	8

Equipped with this knowledge, plus awareness of vacancy rates, rents, property values, and financial market conditions, the private developer could make a rational decision as to the advisability of a housing investment.

Appraisal. Appraisal theory was also utilized on a number of occasions to aid prospective purchasers and sellers as to the market value of particular parcels of land. The data needed for the three approaches to value were available to the student appraiser.

In the application of the cost approach:

1. An indication of the value of the land was available on the "market value of privately owned land" sheet.
2. Costs to reproduce the structure new could be obtained from the local construction industry and the outside economy.
3. The amount of physical depreciation was indicated on the individual economic output sheets.

In applying the income approach, the appraiser has:

1. Estimated the gross income by tracing the

economic history of the property and analyzing anticipated changes in the environment.

2. Estimated the operating expenses in the same manner.

3. By subtraction, computed the net income before recapture (depreciation).

4. Developed or selected an acceptable method and rate for capitalizing the net income.

In applying the market data approach, the appraiser has:

1. Found similar properties in the area for which pertainent sales, rental and operating data are available.

2. Qualified the price as to terms and bona fide nature.

3. Compared the important characteristics of the subject with the corresponding characteristics of each of the comparables, by time, location, and physical factors.

The student would then select the approach which is most applicable to the subject property and determine a final valuation.

Land use studies. One final group of analyses began to emerge in the later rounds of the development of Blue City. Urban land studies including surveys of the intensity of land and residential development, vacant land studies, structural and environmental quality indexes, land value studies, availability of park land and general livability studies, showed that unstructured growth of the city caused numerous urban problems. In this example, intensive residential development occurred along the main western and southern arteries, causing disproportionate traffic congestion, school overcrowding, poor municipal services and general social dissatisfaction. Observing this degeneration, the zoning department initiated a comprehensive master plan for the staged growth of Blue City. This plan, coupled with the support and corresponding plans of the other departments, has insured the future life of Blue City. By proper management of the urban environment the inefficiencies due to imbalance can be minimized. No longer would the public sector blindly respond to the actions of the private sector; now the public sector would stimulate or channel growth where it deemed it most beneficial for the city as a whole.

Interaction of Students

The dynamics of the Game consist of the series of analyses and decisions of the types just described and of development of interpersonal relationships leading to group action through a political and social process.

The students play the Game generally through the economic role. Thus often results in a minimum of student interaction early in the course because of the nature of many economic decisions. That is to say that economic decisions are viewed as beneficial only to the team making the decision. Unnecessary interrelations are thus avoided for the sake of secrecy. Most players use the guise of ignorance when talking with their peers early in the course and their limited contacts are usually attempts to acquire knowledge.

However, as the players' command over the technical content increases, so does their awareness of the necessity of a properly functioning system. The player realizes that his economic aspirations will not be achieved unless his public counterpart can create a suitable "service-rich" environment in which he can operate. One or two students generally emerge quickly with an extensive grasp of the system and its technical content and assume the role of educator. In the course last spring one student had had previous exposure with the model and was quite familiar with its operation. In a fashion similar to the old ward politicians this student would dispense favors, in this case the patronage was in the form of technical explanations, to gain the initial respect of his constituents. Needless to say, it was a simple matter for him to insure his election to the mayoralty of the City.

As time passed, and the other players came to understand their role and the roles of others, they began to realize that the mayor, although helping the city to function, was insuring his own economic prominence at their expense. The coup d'etat was swift. The era of the ward politician had passed and with this passing came the emergence of the city-manager. The political cooperation which grew from this new regime eventually led to full appreciation of the efforts of others and opened up higher levels of discussion concerning city-wide urban problems.

CONCLUSIONS

As is taught in the Game, the conclusions drawn would be relative to objectives. If the objective is to stimulate the student to "dig," i.e., search out the knowledge he needs, then our experience indicates great success. If the objective is to convey a body of knowledge, then our experience indicates that more developmental work is needed in order to program instruction necessary to communicate the body of knowledge.

In the politics of progress, university style, any curriculum without quantitative methods, human type studies, computer usage and gaming is simply not with it. It is as much a case of fashion and politics as it is of curriculum and pedagogy. The process, even in this cynical view, does however improve the effectiveness of what universities are presumably doing.

If, as in the view expressed earlier, the best way to teach and learn is on a one-to-one basis, then the Game is a great innovation. This is so not only because there is more time on a one-to-one ratio of teacher student where the teacher is the professor, but there is a vast increase in the amount of the one-to-one teacher student time where the students teach each other.

Much depends on the philosophy or assumptions, if you wish. For those that hold, what some believe to be an archaic view, that the professor knows all, the student nothing, and let the students come listen, these conclusions on Game experience will be way off base. But, for those who really believe that commencement is the beginning of something, not the end, and that the educational preparation involves more of a student's learning than a professor teaching, then the conclusion is that the Game is a great contribution in the form of providing the attractively packaged opportunity for the student to do what we believe he ought to do (attractively packaged or not).

If the waves of change in university education are following the pattern of the waves of change in other areas of human activity, be it the increase in the speed with which man travels, or his abilities to produce, control and use sound and light, or even his abilities to solve social science problems, then university education will take different forms. There is much to be done with the Game as an instructional device but there is much that has already been done with it as a learning device.

Chapter VIII

THE USE OF THE

CITY MODEL AT GEORGETOWN*

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CITY MODEL AT GEORGETOWN

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I. Introduction

A. Personal Background

I began an active involvement in urban economics in 1964 when I was graduate fellow to the single graduate urban course in the Economics Department at Georgetown University. Five years later, in the Spring of 1969, I began teaching the second graduate urban course to be offered in economics -- The Simulation of Urban System: Econ. 484.

I have continued to teach a Spring course under that title ever since. I have however, never been a fulltime teacher at the university. The class in 1969 was held at the simulation facilities of the Washington Center for Metropolitan Studies and used the CITY I* model as a laboratory device. This first course was subsidized in part by the WCMS through the provision of free computer time, computing services and space. During the course of the semester, the Urban Systems Simulation staff (of which I was a member) at WCMS spun off and formed an independent company called Envirometrics.

The 1970 course was held at the simulation facilities of Envirometrics, and again, CITY I was used as an integral part of the laboratory seminar format. This time it was Envirometrics that subsidized the overhead costs associated with the use of the computerize model.

When the grant from the National Science Foundation was given to Envirometrics to test the use of the CITY MODEL in several different disciplines at several universities, I was very happy to participate on the part of Georgetown University. There was probably no way that I could have continued to use a computerized urban decision-making model in my course without institutional support. This was because none of the desired models could be run at the university computer center with no out-of-pocket cost.

Prior to the beginning of the 1970 course, I had been involved in designing and using urban decision-making models for about four years -- first as a member of the Urban Systems Simulation staff (developers of CITY I) and then as a member of the Envirometrics staff (developers of CITY II, CITY III, and CITY MODEL). As one of the designers of the CITY MODEL and as one of the staff that had run the model on many occasions, I had many ideas about how I would like to use it. The NSF project gave me a chance to try one of the several alternatives I thought would be very beneficial to a group of students.

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*CITY I was funded in large part by a contract from the Office of Construction Services of the U.S. Office of Education

B. Course Description and Class Composition

Figure 1 shows the course syllabus. Note that no prerequisites were required and that students form other disciplines were courted. The assignments and term paper associated with course, were meant to discourage any student not willing to work on a continual basis during the entire semester.

Since the course uses a combination seminar (discussion) - laboratory (decision-making and policy-testing) approach, it was desirable to keep a small class size. After the first two classes, seven students dropped the course leaving eleven persons for the rest of the semester. Undergraduates were allowed to take the course if they received permission. Several did, and the following make-up of students by rank resulted: six graduates, three undergraduates and two graduate auditors. All were economists but two: a planner with eighteen years of experience and a philosophy professor working on a master's degree in economics.

Several of the students held fulltime jobs: one as a banker, another for the U.S. Treasury Department, one student, Bob Ried, was assigned to the class as the university's fellow, which meant he was to aid in the course in any way designated by the instructor.

Figure 1

SYLLABUS

Economics 484: Simulation of Urban Systems
Phil Patterson
Department of Economics, Georgetown University

Prerequisites: None. Students from other disciplines are welcome.

Objectives of the course:

This seminar-laboratory course will focus on decision-making in an urban environment through the use of a computer-based gaming model. The course will deal explicitly with the major subsystems of the urban system, such as employment, transportation, migration, housing, activity systems, the provision of government services and their financing, and others.

Methods of Instruction:

The CITY MODEL, an operational simulation model will be used as the laboratory device for studying the urban system. Students will become decision-makers in a hypothetical metropolitan area. They will be able to pursue whatever objectives they wish and use whatever discipline tools they find helpful.

Assignment and Term Paper

There will be three reading reports and several other assignments of a research nature assigned during the semester. A research paper will be required that deals with a specific urban issue.

Required Texts:

1. Thompson, Wilber R. A Preface to Urban Economics. Baltimore: The Johns Hopkins Press, for Resources for the Future, Inc., 1965. ($2.95 softback copy)
2. Perloff, Harvey S. and Lowdon, Wingo Jr. editors. Issues in Urban Economics. Baltimore: The Johns Hopkins Press, for Resources for the Future, Inc., 1968. ($5.00 softback copy)

Location:

The course will be conducted at the simulation facilities of Envirometrics, Inc., on the fourth floor of 1100 Seventeenth Street, N.W., Washington, D.C. 20036. The class will meet at 6:30 each Wednesday.

II. The Course

The operation of the course was strongly influenced by my previous two uses of the CITY I model in similar circumstances. There were, however, fewer changes to the purposes of the course than to the structure of the course.

A. Purpose of the Course

The single overriding purpose of the course was to provide the students with an opportunity to learn by being placed in a position of decision-making authority. Some of the general things to be learned were:

1. The use and applicability of the box of theoretical tools they had acquired in other classes,
2. The workings of a complex systems model that was designed to be a simplified reflection of the real world urban system,
3. The importance of goals and norms in policy-making and in the life of any urban area,
4. The competitive and cooperative nature of decisions in the economic, social and governmental sectors of any metropolitan area.

Several more specific goals of the course were to:

1. Acquaint the students to some of the basic literature in urban economics.
2. Provide through reading lists and class reading reports some insight into the literature in systems theory, model building, and educational games.
3. Encourage original thought through the writing of a research paper in a topic of the students' choosing.
4. Use the CITY MODEL as the integrating element for all the activity that took place in the course.

The last goal was of particular importance since past experience had shown that a holistic model of this type could be helpful in relating the theoretical literature to every-day urban issues and problems. In fact, my own understanding and interpretation of the literature had changed dramatically once I had become involved in designing and operating complex urban decision-making models.

B. Course Structure

1. Influence of Previous Experience

Even though the CITY MODEL is a much more powerful tool than the CITY I model that I had used in my previous two courses, I did not depart radically from the format I would have used had I still been using CITY I. My previous two semesters convinced me to use a few strategies that I would have used regardless of the model employed.

First, start playing the game as early as possible but preceed it by the more simple manual game of CLUG (Community Land Use Game).[1] The reason for starting play early is that almost any urban issue that comes up in the course can be related to the model (either to a factor contained in the model or as a factor that could be added to the "game" or to the "model").[2] The reason for starting with CLUG instead of CITY MODEL is that a few students tend to make serious mistakes based upon a misunderstanding of the model in the first or second round of play that plague them for the rest of the semester. By playing CLUG first, these students have the chance to make the mistakes, and learn from them (e.g., overbuilding personal goods because they do not realize that all sales must be made locally, or purchasing land at inflated prices miles away from roads or terminals).

Second, maintain a seminar atmosphere by having periodic discussion in which all students were encouraged to participate. This was to assure that each student took a stand on whatever topic the discussion dealt with.

Third, allow the momentum and interests of the class to alter any pre-planned schedule for an individual class meeting. When a lively class discussion developed and it appeared to be constructive, it was allowed to run its course.

---

[1] Developed by Allan Feldt, now at the University of Michigan

[2] A useful distinction can be made between the "model" and "game" components of a run of the CITY MODEL. Strictly speaking the type of inputs, the operating programs, and the computer output comprise the model. These do not change from one run to another. The starting city configuration, the allocation of assets to teams, the allocation of players to teams, the norms of the players, the institutions they create, and the win criteria they establish comprise the "game." Together they tend to be unique for each group of users of the CITY MODEL.

A major difference between CITY I and CITY MODEL from the player viewpoint is the number of sectors. CITY I has an economic and government sector. CITY MODEL has those two plus a social sector. With CITY I I had always had one or two person teams that played the economic and government sectors simultaneously. I decided to play CITY MODEL with one or two person teams that would play all three sectors simultaneously. But because each sector is quite complex, I opted for introducing the sectors one at a time; economic in round 1, social in round 2, and government in round 3. More will be said about this later.

2. The Schedule

A rough class by class schedule was prepared before the start of the semester, but no schedule was presented to the student until the fourth class meeting. The following is a short description of what happened during the first four meetings. Deviations from the semi-formal schedule will follow after that. The fourteen class meetings[2] are identified by small Roman numerals.

i. The first class meeting started with the students filling out a questionnaire. The next step was to discuss games of sport in terms of the characteristics in Figure 2. Each student first chose a sport and then we went down the list and talked about how each sport dealt with each characteristic. It did not take long to see that even the limited subset of games of sport showed tremendous variation in game characteristics. The students differed on what they considered chance factors in sports, spatial boundaries, and overall purpose.

The second part of the meeting was spent playing CLUG. I had modified the game slightly and compressed the rules into a few pages (Appendix A) and play took place on xeroxed maps of the game board. Game money from two sets of Monopoly supplied the only other needed materials Two separate games were conducted simultaneously because there were 14 students and I wanted each student to be a separate team. Play was quite lively.

---

[2] Class began at 6:30 and was scheduled to end at 8:15, but we seldom broke up before 9:30.

Figure 2

CHARACTERISTICS OF GAMES

- Players
  - Number
  - Objectives
  - Skill
  - Preparation
  - Energy or Strength
  - Overall Purpose
  - Chance Factor
- Physical Apparatus
  - Equipment
  - Player Clothing
  - Space (boundaries)
  - Weather Conditions
- Game Structure
  - Rules
  - Pay-offs
  - Resources
  - Calculations
  - Referee
- Time
  - Starting and Stopping
  - Cycle
  - Real Time and Game Time
- Zero or Non-Zero Sum

ii. The second meeting was spent continuing the play of CLUG. Two new students came and they were both assigned to the same city. Since they came in during a middle of a round, they had no land and therefore they had to purchase from other players. I gave these two new teams the option about an hour after the start of class to invest in the other city if they wished. They did not choose to do so, but this would be an interesting idea to test with regard to CLUG or the CITY MODEL. Have several different plays going simultaneously, and allow a few teams to represent national businesses that can choose to invest in one of several different local systems.

iii. Play of CLUG stopped and I asked for ideas on how the students might build a model starting from the CLUG framework. The discussion did not prove as useful as it had in a previous course when the same technique was tried. Maybe the reason was that I did not request that a one page written description of a CLUG modification be handed in as I had before.

I discussed the process that the staff at Envirometrics took to evolve from CLUG to Region to City I and then to CITY MODEL. I passed out some materials that compared the four models.

I then distributed copies of the players' manual and first round output for the economic sector only. I told the class to prepare for playing the economic sector at the next meeting.

iv. The fourth meeting saw the start of the economic decision-making. The confusion level was high during Round 2, but the small number of students and the liberal amount of time made my job easier, even if it may not have helped them. I passed out the schedule for the remainder of the course and spent about twenty minutes explaining the social sector.

The plan for the remaining ten class meetings is now presented, and comments on how close reality followed the plan will follow in a summary section.

v. Discuss the major social sector operating programs (migration, housing, employment, time allocation, school allocation, transportation, and boycott). Play Round 3. Elect government.

vi. Hold a town meeting (discuss public sector). Start government decision-making. Play Round 4. Read Chapters 7 and 9 in Thompson.

vii. Systems reading reports due. Each student will discuss his report and class will comment. Play Round 5.

viii. Final determination of research paper assignments. Play Round 6. Read Chapter 5 in Thompson.

ix. Model reading reports due. Discuss. Read Britton Harris's article in Issues in Urban Economics. Presentation of Urban Dynamics Model.

x. Play Round 7. Read Dick Netzer's article in Issues in Urban Economics.

xi. Game reading reports due. Discuss. Play Round 8.

xii. Discuss decision-making in the previous rounds. Talk about Zero Population Growth Policy, Master Planning, New Town Development, etc. Read Werner Hirsch's article in Issues in Urban Economics.

xiii. Play final Round. Read Julius Margolis's article in Issues in Urban Economics.

xiv. Research reports due. Debriefing of entire course. Complete critique questionnaires.

3. Summary of Experience in Following the Schedule

Class v. went according to plan. The election was not a very realistic or dynamic exercise. One person sought the Chairman position and got it. He appointed a bureaucracy on the basis of assigning government jobs to the first students that asked for them.

Class vi. followed the plan, but the town meeting was not an exciting event. This is probably due to the small class size and the lack of strong competing objectives among the teams. Each team had an economic function, a social function, and a government function, so the teams were more similar than different.

Class vii was devoted almost entirely to the systems reports. Computer output was passed out but decisions were not made.

The first part of Class viii was spent discussing final research paper assignments. Round 5 was played.

Class ix was spent discussing the students' reports on other urban models. There was not enough time for a round of play because Harris' article was discussed in some detail.

Class x had a presentation of the Urban Dynamics model by Bob Reid and myself. Netzer's article was not discussed. Round 6 was played.

Class xi saw the students make their reports on other gaming models. No round was played.

Class xii saw the play of round 7 but discussion of Zero Population Growth, the other topics, and Kirsche's article was minimal.

Class xiii saw the final round of play. In a sense some end game strategy was allowed because no one made any construction decisions (since they would not appear on the next output). Margolis's article was not discussed.

Class xiv was spent debriefing the course and filling out a final questionnaire. Only two research papers were received at this time. The remainder came in within a month after the last class.

In sum, the class was not able to discuss as many of the readings as had been planned, the game play took the greater part of any class in which a round was played, and the student reading reports were more time consuming than planned. Better use could have been made of fully analyzing the Bluecity status, with less time spend summarizing the student reports.

III. The Play of the Model

A. Overview

The model was run seven times after the receipt of Round 1 output which means that play ended with a Round 8 output. Since the model was run with teams operating Construction Industries, there was a round delay for all construction. Therefore, in the final round no construction decisions were made. In Round 1*, only economic decisions were made. In Round 2, economic decisions and social decisions were made. The first full round of play in which the students assumed full decision-making power was Round 3. Thus, the full range of the model was available to the students for four rounds of play (Rounds 3, 4, 5, and 6).

Teams were comprised of one or two members and were matched alphabetically in the economic and social sectors (i.e., Economic Team A was also Social Team AA, etc.). Government positions were changed once (at the end of round 5), thus allowing each team to exercise two government functions.

Figure 3 shows the population growth for Georgetown** over the seven rounds of decision-making. The total population growth of 68 percent was quite large in terms of real life cities. This total growth over seven rounds converts to an annual rate of growth of 7.7 percent and places Georgetown up in the fast growing class of cities such as Phoenix, San Jose, For Lauderdale, Las Vegas, and several other cities during the decade of the sixties.

Figure 4 shows several indicators for Georgetown over the eight simulated years.

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*For convention, "In Round 1" or "Round 1 decisions" will refer to decisions that were made to create a Round 2 output.

**The Georgetown University play of Blue City will be referred to as "Georgetown" to distinguish it from the other plays.

FIGURE 3

POPULATION GROWTH IN THE CITY OF GEORGETOWN

(log scale)

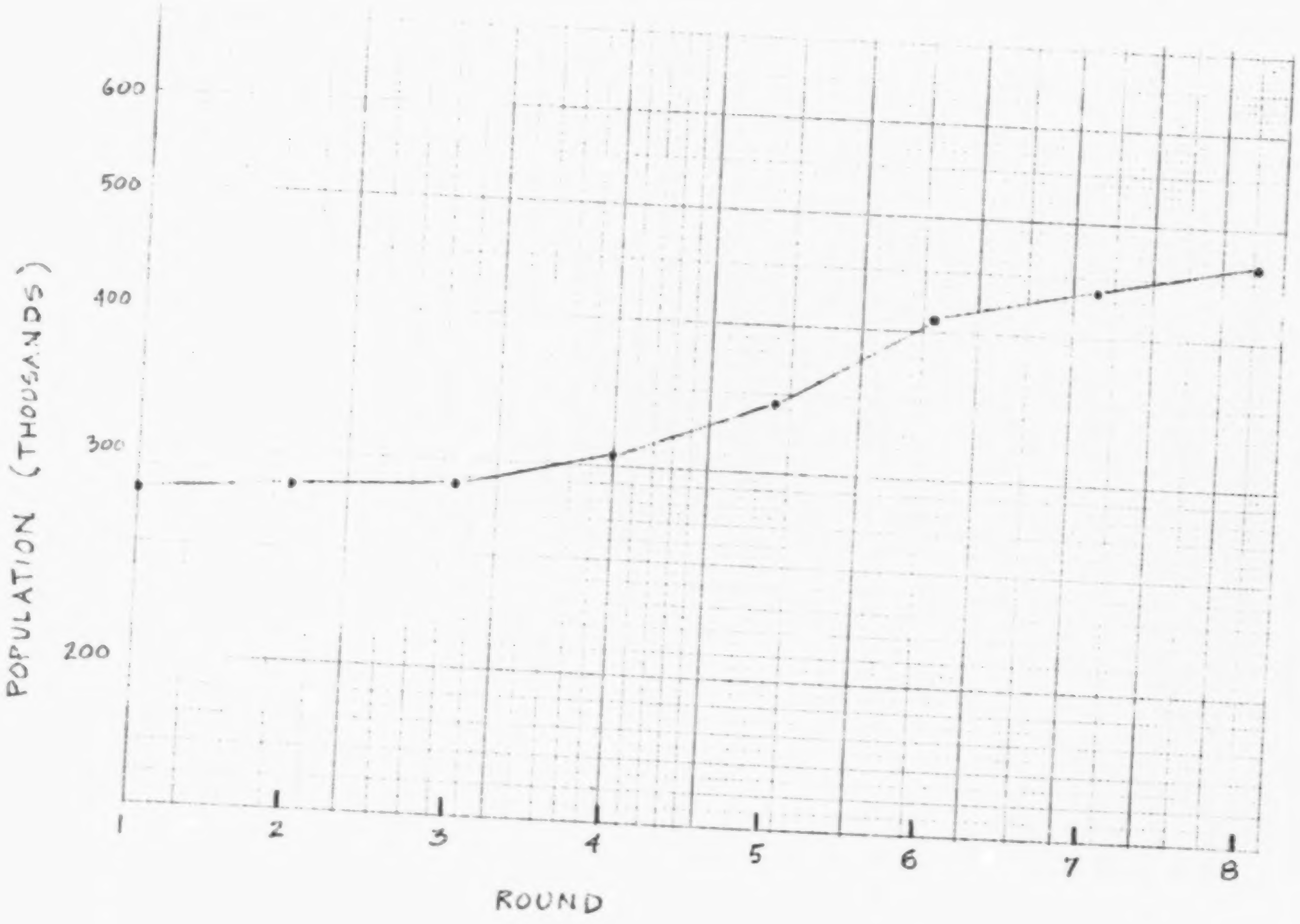

FIGURE 4

GEORGETOWN INDICATORS

	Round							
	1	2	3	4	5	6	7	8
% Change in Population	0	2	1	7	10	19	13	
Population Per Residential Square Mile	1940	1942	1972	2127	2326	2546	2430	
Average Housing Dissatisfaction	NA	112	109	107	108	90	93	
Average Educational Level	60	57	57	57	54	59	58	
Vacancy Rate	6	3	3	3	-9	-3	2	
Employed Workers (thousands)	81.6	81.4	88.7	95.9	107.9	126.0	136.0	
Percent of Workers Earning Under $5000	38	38	37	33	36	31	34	

B. General and Departmental Indicators

Several useful city indicators that are not contained in the summary Demographic and Economic Statistics are shown in Figure 5. The indicators appear in the Figure in the same sequence as they appear in the output. For example, the first information after Edits is the details on migration. The key indicator in the Georgetown City is the in-migration, because jobs were always available in all three classes for Rounds 4, 5, and 6. It appears very erratic, but this is primarily due to the amount and type of newly constructed housing. For example, in Round 5 mostly, PL's moved in, and the only new housing constructed was completely occupied by Pl's. In Round 6, mostly PH's moved in, and this was because the new RC2 at 10826 was filled to over capacity by one PM and 59 PH's. Likewise, the new level of RB at 9236 was filled with 7 PH's. In other words, if housing had not been in short supply, the in-migration by round would have been even for the three classes.

A very useful indicator can be derived from the Employment Details. Pl's by class employed by SC, MS, or BUS pay a systemwide calculated average transportation cost and take an average amount of time to go to work, since the actual cost and time cannot be derived due to the fact that there is no specified location for SC, MS, or BUS jobs.* Therefore, the transportation cost and time for employees of these government jobs give a useful measure of changing costs by class and over time. Since the calculated average figure takes into account other Pl's that use cars, or buses (and/or rapid rail if one exists), or walk to work. Thus, a declining dollar cost over time such as existed for PL's from Round 1 to Round 5, would represent such things as more bus ridership, more walking to work (Pl's working at adjacent parcels), or reduced highway congestion. In general, lower values would be beneficial to the social sector.

The average transportation costs (which are based on last round's data) reached their lowest point in Round 5, the year after bus ridership reached its maximum value. The change between Round 2 and 8 was detrimental to all but the PL class. The average PH in Round 8 was spending 32 percent more and the average PM 47 percent more to get to work than in Round 2. The transportation sector of the local system certainly did not serve these citizens well! The average travel time to work was stable at 5 units for all the rounds except the last when it jumped to 6. Thus, the average worker was spending 20

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*The SC and MS departments hire Pl's and then assign them to individual SC and MS units. Pl's are not hired by the individual SC and MS units.

Figure 5

G. U. Indicators

		Round						
Migration	(Pl's)	2	3	4	5	6	7	8
In -	PL	7	7	7	46	9	36	17
	PM	9	10	17	26	44	18	26
	PH	10	10	19	3	87	57	16
Out -	PL	0	10	3	12	12	6	17
	PM	5	12	2	2	2	3	1
	PH	14	7	1	2	1	3	4
Employment								
Average Cost of Trans.	PL	260	240	220	190	220	230	240
	PM	190	200	170	150	260	260	280
	PH	280	300	280	270	330	260	370
Average Trans. time		5	5	5	5	5	5	6
PL unemployed		35	3	0 (82)	0 (61)	0 (70)	0 (42)	0 (54)
PM underemployed		14	0	0 (63)	0 (69)	0 (33)	0 (11)	0 (0)
PH underemployed		3	0	0 (89)	0 (110)	0 (41)	0 (0)	0 (33)
Highway								
Road Maintenance ($ million)		.824	.774	.682	2.18	1.36	1.64	1.92
	Road Type							
Average Dep. before mainten.	1	1.1	.9	1.1	1.8	1.9	2.2	2.0
	2	1.0	1.3	1.0	1.2	1.3	1.5	1.4
	3	.9	.6	.8	2.0	2.0	2.3	2.2
Bus								
Fares ($ million)		.466	.969	1.25	1.34	1.33	1.88	.68
Current Expenditures		2.57	10.0	7.78	6.86	5.68	5.22	2.95
Fare Schedule		15¢ + 2¢	0 + 5¢	0 +5¢	10¢ + 5¢	10¢ + 5¢	10¢ + 5¢	10¢ +5¢
Passengers (in thous.)		4.9	19.8	29.1	13.6	13.3	18.4	6.6

	Round						
School	2	3	4	5	6	7	8
High Use Index	197	185	85	47	96	88	95
Low Use Index	59	62	47	0	68	62	60
Ratio of Private/Public	.205	.186	.244	3.341	.243	.303	.352
Unmet Adult Education Demand	5085	4670	3414	8433	291	3716	4853
Municipal Services							
High MS Index	150	151	152	143	149	168	175
Low MS Index	143	143	135	121	114	114	113
Welfare Payment	$1500	$1500	$1500	$1500	$1500	$1500	$1500
Utilities							
High Cost/Unit Plant	$9704	8783	8607	8056	8271	8268	11,718
Low Cost/Unit Plant	$6926	7658	7777	7517	7106	6816	6,816
Charge ($1000)	$10	$10	$10	$9.7	$9.7	$9.7	$9.9
Revenue/Expenses	1.317	.879	1.258	.915	1.211	.755	1.230
Parks							
Population/Sq. Mile (in thousands)	35.4	35.8	34.3	34.2	34.2	33.3	33.0
Chairman							
Ratio of Appropriations to Taxes	1.29	1.21	.83	.74	.86	.93	.93
Auto Tax ($1 m)	.204	.194	.962	1.48	1.84	2.06	2.07

percent more time getting to work in Round 8 than in Round 2. As city size grows, one would expect average travel costs and time to increase if offsetting improvements are not made in the transportation system, and this in exactly what happened.

Road maintenance costs increased significantly over time, and this was due primarily to more people using the same old roads. It is true that some new roads were built but as shown in Figure 5a the number of congested roads increased from 3 to 13 between Rounds 2 and 8.

The bus operation was a frustrating task for all three persons who tried a crack at it. Passengers peaked in Round 4, but the relative cash loss to the company was in Round 8 when expenditures exceeded fares by only 177 percent! A research paper by one of the hapless bus operators (Appendix B) presents a technique that might make the bus have a chance of turning a profit and still serve a large numer of people.

The School Department started with a bad situation, in terms of disparity between the best and worst school units, and managed to make things better over time. The percentage of students going to private schools, however, increased over time and was very large in Round 5 when the local School Department experienced a wholesale exodus on the part of its teachers because of the low wages offered. The adult education program nearly met all the demand in only one year.

The Municipal Services Department started out with a system that was overcrowded and ended up with a slightly less overcrowded situation, but one that had more inequities than before. That is the worst served area was 17 percent worse and the best served area was 21 percent better off at the end of the seven rounds of decision-making. The cost to the economic sector via increased maintenance charges as the result of poor MS service must have been ignored by the entrepreneurs of the local system.

The Utility Department was improving the cost per unit at the high cost plant very nicely until the last round, when the cost per unit jumped 42 percent. The low cost plant showed a small improvement over the seven rounds. The revenue/expenditure figure is deceiving because part of the expenditures were accounted for by cash transfers to other government departments.

The population per square mile of parkland showed a small decline, which means a relative increase in the green space per capita.

Figure 5a

Highway Congestion (% of capacity used)
in
Georgetown City

				Round				
Route	1	2	3	4	5	6	7	8
9526	58	44	87	87	81	90	116	70
9528	62	84	161	92	94	102	93	116
9530	144	172	211	174	186	208	156	220**
9532	87	84	91	42	96	114	132	133**
10126	67	61	30	24	92	156	147	141
9631	40	41	27	44	101	115	142	150*
10231	0	0	0	11	117	114	147	115*
9732	6	15	18	37	75	79	83	113
9231	86	110	94	84	115	134	152	155*
9431	118	142	110	120	150	156	155	185*
9831	38	34	7	21	98	88	114	100*
10031	40	41	20	32	98	86	133	100*
10431	0	0	0	11	101	84	108	83*
9623	45	18	107	117	115	83	116	141
10930	0	0	0	36	91	91	128	111
9427	98	55	47	83	45	61	108	18
Number of Congested Roads	2	3	4	3	7	8	14	13
Roads with over 150 Congestion	0	1	2	1	2	3	3	4

*Road is at maximum size
**Land not available for larger capacity road

C. Frequency of Decisions

Figure 6 shows some of the major decision categories and the number of successful and unsuccessful decisions made each round. Two conclusions are readily apparent. First, a large number of attempted decisions were flunked because of procedural or substantive errors. In face, the percent of decisions rejected did not decline much over time. Also, in some cases such as housing builds in Round 6, the rejected decisions were not even submitted in the following round.

Second, the economic decisions far outweighed the government decisions, and both types far outweighed social decisions. Purchase decisions declined after peaking Round 3. Rent changes were fairly numerous, and most were increases levied by landlords in response to a seller's market. Price changes were not numerous, as one would expect given the monopoly position of most of the commercial establishments. Salary changes peaked during the rounds when labor was most scarce. The activity in maintenance decisions peaked in Rounds 2 (the first chance the teams had to improve the quality of housing) and 5 (for an unknown reason). Teams quickly realized the alternative uses of their money in outside investments. Disinvestment did occur more toward the later rounds as the national cycle declined and as local investment money became scarce. Tremendous building of businesses took place in Round 2, and much of the rest of the play centered around adjusting to meet this growth available in jobs. The housing shortage was never sufficiently solved, but the gap opened up in Round 4 was narrowed.

In the social sector, many time allocations were made when the first opportunity in Round 3 presented itself. After change took place in the dollar values of time. More lowering of dollar values would have assisted the Bus Company in its efforts to gain maximum ridership.

All the government decisions in Rounds 2 and 3 were director inputs, made in response to needs expressed by the economic or social sectors. Appropriations were altered from year to year (unchanged appropriation levels require an annual input). Tax policy was exercised in Rounds 4, 6, and 7. Wide spread assessment changes were made in Round 4 and were coordinated with the tax policy in an attempt to intice more residential development. More residential development did take place in the following round, but the cause-effect relationship might be tenuous. Most of the other departmental activity showed little pattern other than fewer decisions over time. The one exception to this is the Planning and Zoning Department which carried out a master zoning plan in Rounds 7 and 8.

Figure 6

FREQUENCY OF DECISIONS BY ROUND - GEORGETOWN*

	ROUND						
ECONOMIC	2	3	4	5	6	7	8
Purchases	6 $\boxed{20}$	37 $\boxed{3}$	24	25	2	12	-
Rents	15	6	11	12	8	6 $\boxed{1}$	6
Prices	0	0	1	1	1	1	0
Salaries	0	1	9	12 $\boxed{1}$	13 $\boxed{1}$	4	1
Maintenance	15	4	2	11	4	6	0
Invest	7	5	2	4	1	3	3
Disinvest	0	1	0	2	1	2	0
Build-Business Levels	$\boxed{5}$	9 $\boxed{4}$	1 $\boxed{2}$	1 $\boxed{1}$	1 $\boxed{1}$	1 $\boxed{2}$	-
Build-Housing Units	3	31	7 $\boxed{128}$	98 $\boxed{58}$	73 $\boxed{97}$	18	-
SOCIAL							
Time	-	29	15	7 $\boxed{11}$	3 $\boxed{10}$	9 $\boxed{12}$	0
Value	-	0	2	0	3	0	0
GOVERNMENT							
Appropriations	-	5	3	3	3	4	1 $\boxed{1}$
Taxes	-	-	4	0	3	2	0
Assessment	-	-	12 $\boxed{2}$	-	-	-	-
Schools	-	-	15	5 $\boxed{4}$	9	4	0
Municipal Services	-	-	6	6 $\boxed{3}$	4	1	0
Highways	-	-	17	21	5 $\boxed{1}$	5	-
Bus	-	4	-	11 $\boxed{2}$	6	2 $\boxed{1}$	2
Planning-Zoning	2	6	26	3	13	106 $\boxed{51}$	58
Utilities	$\boxed{1}$	8	0	6	2	6 $\boxed{3}$	8 $\boxed{1}$

* Figures in boxes are the number of decisions rejected for procedural or substantive errors. Procedural errors are coding mistakes and substantive errors are those that reflect system factors that prevent a decision from being made (e.g., lack of cash, improper zoning, lack of utilities, etc.)

D. The Economic Sector

Midway through the play, the students were required to calculate the rate of return on all of their properties and to trace back the rate of return for the two most profitable and the two least profitable investments. This assignment proved to be a revelation to a number of the students who were unaware of the declining profit rate that was brought about by a rash of speculative overbuilding in Round 3.

The economic sector tended to build intensively as opposed to extensively. Not many new parcels of land were developed; rather, the original undeveloped land within the initial development area was built upon. In fact, only one new parcel was used for housing, even though the population increased by 68 percent.

E. The Social Sector

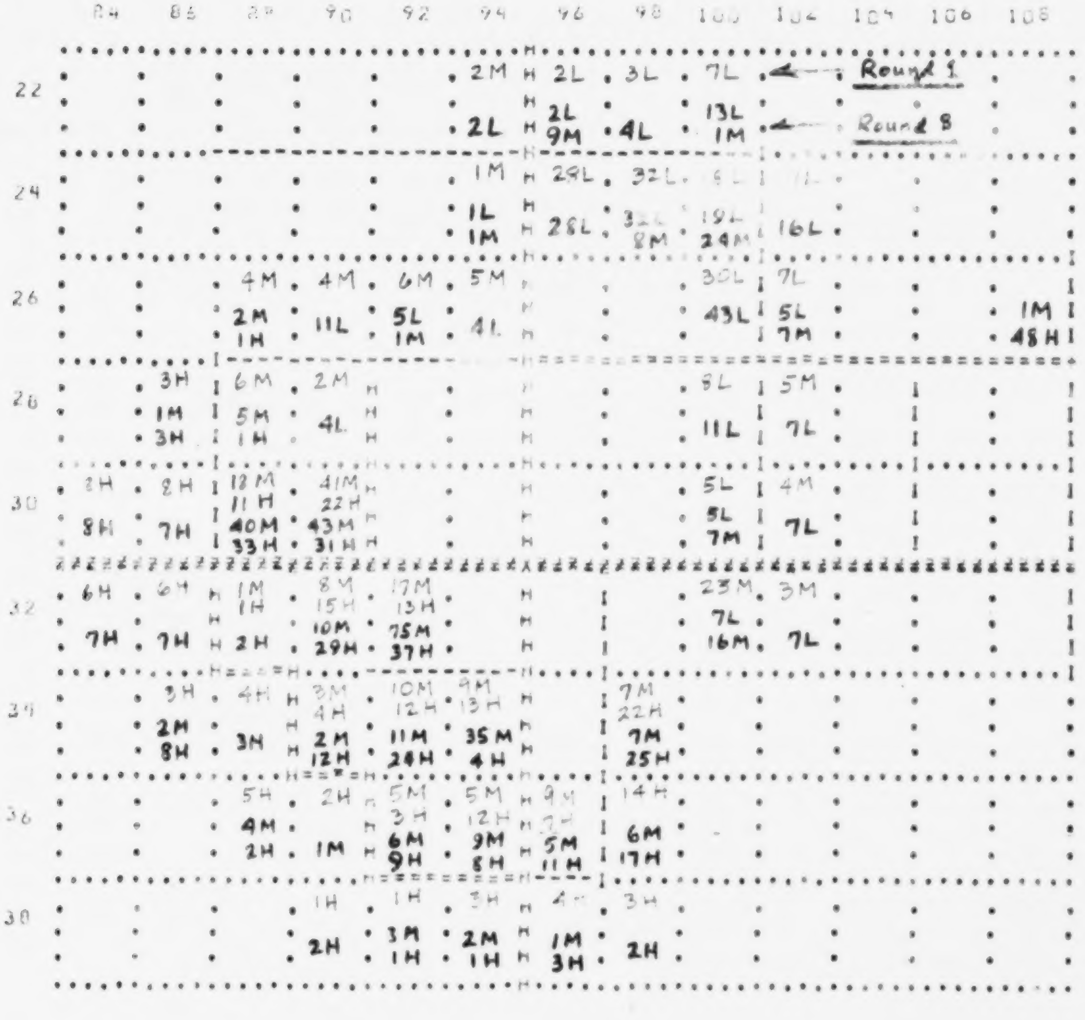
Although the students were not active in the social sector, two major social indicators (per capita personal income and dissatisfaction index) both improved over time. The dissatisfaction level, however, did not decline as much as in most of the other NSF cities. On the other hand, PCPI was higher in Georgetown by a large margin than in the other NSF cities.

Figure 7 shows the number and distribution of Pl's by class at the beginning (top of each parcel) and at the end (bottom of each parcel) of play. Note that there is much more income integration at the end of round 8 than there was at beginning of play.

Figure 7

GEORGETOWN CITY

Numbers of Population Units by Class and Parcel, Rounds 1 and 8*



84
86
88
90
92
94
96
98
100
102
104
106
108
22
24
26
28
30
32
34
36
38
Round 1
Round 8

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*There was a 68 percent growth in population over the eight rounds, and there were 17 more parcels with mixed class in Round 8 than in Round 1.

F. The Government Sector

Government activity in the Georgetown City in most of the functional areas appeared to serve the demands of the economic sector. For example, roads and utilities were placed in the places and in the amounts necessary for the planned economic development. Both of these departments showed indications of operating less efficiently over time.

The Highway Department was spending 30 cents per capita for highway maintenance in Round 1 and 42 cents per capita for maintenance in Round 8. With regard to the Utility Department, the least efficient plant had a production cost per unit of output that was 21 percent higher at the end of the eight rounds. The production costs of the most efficient plant, on the other hand, declined 2 percent.

The School Department reduced the level of inequality (ratio of use index at the most crowded school to the use index at the least crowded school) over the eight years from 3.3 to 1.6. Inequality increased with regard for municipal services, in that the inequality index went from 1.05 in Round 1 to 1.55 in Round 8. The population per square mile of parkland declined slightly from 35.4 to 33.0 over the eight rounds.

G. Summary

Student activity in the three sectors was very uneven. Economic decisions dominated all others, and social decisions were made sparingly. This did not, however, generate an improvement in economic indicators at the expense of indicators in the other two sectors. In fact, the average rate of return on investments in the system declined over the eight rounds. This was largely due to the overbuilding that occurred midway in the play. This suggests that the students may have observed and learned more about the interaction of economic decisions in the local system than of either government or social decisions. A personal observation is that the students learn more from the model in the sections of the model that are most experimented with in a laboratory sense.

IV. Conclusions, Recommendations and Suggestions

A. Conclusions

1. The CITY MODEL provides an excellent tool around which to develop an urban economics course, an urban laboratory, or an economic decision-making seminar. A professor can focus attention on (1) tying the urban and regional economics literature to the model play, (2) allowing the students to experiment with decision-making (current policy alternatives or ones of their own design), and (3) providing the students with a chance to demonstrate their ability to use the box of economic tools that they have assembled in previous courses.

2. The disadvantagages of having a student play all three sectors simultaneously outweighs the advantages. The main disadvantage is that the social sector receives very little attention when a student has an option to make decisions in the other sectors. Perhaps, because of the nature of the social sector, students should never have any other responsibilities when they are playing the social sector.

Other disadvantages of playing the three sectors simultaneously are the handling of three sets of output, making decisions that cover the full scope of the model, establishing objectives in three diverse areas.

The advantages of playing all three sectors simultaneously are the educational feature of having conflicting interests, seeing the model and the city from three points of view at the same time, and playing the model with a minimum number of students.

3. The CITY MODEL is a rich enough laboratory device that caution should be used as to how many complementary exercises are undertaken during the course of a single semester. I used parts of nine of the fourteen classes with game plays (two for CLUG and seven for CITY MODEL) and the remainder of the class time was devoted to discussion of readings, research papers, Urban Dynamics, and the play. Taken together, I feel that I attempted to cover too much ground. A number of readings were never discussed, and insufficient time was given to an analysis of the play.

4. The play of a round of the model is complex and engrossing enough so that it is usually necessary to devote a full class period to play. A class session that is split between game play and any topic other than discussion of the play has a high chance of being unsatisfactory for either the play or the other exercise. On a number of occasions a class session began with a discussion of assigned readings and finished with a round of play. In each case, as student questionnaires confirmed, the discussion was given secondary effort as students looked ahead to the play. At the same time, the play of the round did not receive the time it needed.

5. The mechancis of the model are so formidable during the first two or three rounds, that once the students learn these, there is a chance of a let-down on the part of some of them. There is the danger that some of the students will feel that the purpose of playing CITY MODEL is to learn how to play it, rather than to learn by making decisions and receiving continual feedback in a hypothetical urban environment.

B. Recommendations

The recommendations will be listed under three categories of use of the CITY MODEL; those that apply to any user of the model in a classroom situation, those that apply specifically to the use of the model in an economics course, and those that apply to the type of seminar-laboratory course that I offered. These recommendations will be followed by some general suggestions concerning the use of the model.

1. Classroom Use of City Model

a. Assign the social, economic, and government teams in the model (AA, A, and SC, etc.) in such a way that the students perform tasks in only one sector at a time. If there are a small number of students (less than 22) make all the gameroom teams (as opposed to the computer output or model teams) composed of one player. For example, if there are only twelve students, they would each comprise a team (numbered 1 through 12) and the gameroom team 1 might be assigned the model teams of AA and DD, team 2 might be the sum of model economic teams B and C, and team 12 might be the sum of SC and MS.

If there are more than 25 students but less than 50, it would be necessary to make some two student gameroom teams.*

b. The CITY MODEL functions performed by a gameroom team should change several times during the course of the play. The ideal way to have teams assume government positions is to be elected or appointed to them. This may not be possible at the start of play or the political dynamics may never evolve, so the director must be ready to change team assignments whenever he sees the need or the benefit of doing so. Students benefit from playing several widely different functions during the course of the play.

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*All of these recommendations are made assuming that the user starts with the Blue City configuration which has seven model economic teams, seven social teams, and from eight to eleven government teams. If one of the other starting configurations were used the number of students constituting cut off points would be different. In fact, the director who favors one man teams and has a large class might want to use the Big City configuration which has 36 distinct model teams or TriCity which has 44 distinct teams. On the other hand, a very small class might get more use out of playing Moray County which has a starting population of only 11,500 at the start of play and only about ten model teams.

c. Have access to a graduate assistant who can handle the editing of player input forms, punch the input cards, handle the running of the output, and provide overall assistance during the run of the model. This student could very well be a member of the class. In either case, he should be well versed in the operation of the model and in the rules of the game.

This student will spend on the average about an hour editing decisions, a little bit more punching them, and whatever time is needed to input the decisions and receive output for each round of play.

d. Do not attempt to cover too much ground during the course, and thereby take away time from valuable discussions of the "model" and the "game" that was played by the class. The assumptions of the model can usefully be questioned and alternative ones proposed. The goals, norms, and results generated by the game play should be fully explored and the relation between individual and collective objectives analyzed. Attempts to define the "goodness" of the final status of the city should be made.

e. Do not split a class meeting between play of the model and some assignment not directly related to the play. Do not expect to get the full attention of the students during a class once output has been handed out.

f. Devise several strategies for handling situations when a student or the class become let down as a result of learning the mechanics of the play or finding their function too easy to perform. If the whole class is in trouble, an outside influence such as a new state regulation setting school quality levels, utility rates, bonding, etc., might be made. Or natural disaster might strike in the form of cash drains from all economic teams or buildings being destroyed (director inputs). Or a new federal program to assist new town development might be made, creative federal aid programs might be introduced, or a federally imposed population level might be promulgated.

In the case where an individual finds the game too easy, he might be given an assignment to calculate his actual rate of return of cost-effectiveness. Or he might be given a tougher assignment. The tough assignments are Bus Company operator (have the service pay for itself through fares), Highway Department (eliminate all congestion), and Assessment Department (assess according to the best use of the land).

2. Use of CITY MODEL in an Economics Course

a. Tie the urban economics literature to the model when possible, and show where the model does not explicitly deal with elements of economic theory. In the latter case, there is a challenge to the student to devise a way for including the missing element. For example, the issue of water pollution is absent from the version of the CITY MODEL used in the NSF program. The student who is interested in this omission could devise a way for adding the water subsystem to the present urban system contained in the CITY MODEL.

b. Encourage participation in the course by students from other disciplines. The model is an interdisciplinary device through which the student of economics may learn to appreciate the usefulness and limitations of his particular field of study. This learning will be aided if other students in the course have some formal background in the complementary disciplines of geography, political science, urban affairs, and sociology. Likewise, the student from the other disciplines may gain a better appreciation for the usefullness of economics.

c. Assign a research paper that is closely related to the use, content, or outcome of the CITY MODEL. Student papers over a number of semesters will build up a helpful library of source material and ideas for future classes. In this way, the output from the students may be able to evolve to a larger research product than any single semester would be able to.

d. Assign specific economic projects and reserve adequate time for the discussion of economic topics. The first might be accomplished with assignments to calculate the economic base of the simulated area, perform a PPBS analysis of the government, calculate rates of return for various investments, or estimate benefit/cost ratios for specific government projects. The discussions could deal with these topics in addition to such other as the place of macro and micro theory in the model, the economics of space, zero population growth policies, new town developments, model cities programs, revenue sharing, conventional intergovernmental fiscal relations, and others.

3. Use of CITY MODEL in an Urban Seminar-Laboratory Course

a. Have the class scheduled at such a time that the students do not have any limitations on the length of time they can stay at any one meeting. The seminar discussions that evolve or are planned should be ended by the students on a voluntary basis and not by a ring of a bell. But allow students to individually drift away at any point after the first several hours.

b. Keep the class size to under 20 students so that they can easily get to know one another on a first name basis, and so that seminar-type discussions in which everyone participates are possible.

c. Place strong emphasis on starting the research paper early so that discussion of the rough drafts can take place in the seminar when useful. Encourage the students to perform all of their assignments in such a way that it instructs the rest of the class and furthers the class learning experience.

C. Suggestions

1. Make the city decision-making a long run project by having the second semester begin play where the first semester class left off. This would accomplish the dual purposes of providing the first class with an added incentive for looking at the city and their own functions in a serious way (and avoiding any end game strategies) and of giving the second class a detailed city history from which to learn the model more easily and see the reasons for the present status of the city.

2. Attempt to load data into the model for a city chosen by you or your class. This could well be a class project that would not yield a usable configuration until the following semester. Making decisions for what looks like a real city may be of some benefit and the process one must go through to load a city teaches you a great deal about data availability, parameter fitting, and the model itself.

3. With a very large class or with several classes, play a number of CITY MODEL configurations simultaneously and allow a few players to act as national businessmen who may invest a specified amount of money in any of the cities, in whatever desired mix each year.

4. Alter the assets of economic teams before the start of play by making some teams have only industries, other only commercial establishments, and others only residences. Team cash balances can be reduced or increased to make growth more difficult or easier.

APPENDIX A

Rules for CLUG (Community Land Use Game)

1. Playing Board

CLUG is played on a board consisting of a 10 x 10 matrix of squares. Each square (parcel) represents a square mile of land. Any square can be referred to by its even numbered coordinates appearing at the edge of the board. Major highways and utility service can be located along any lines on the board with appropriate odd numbers used to indicate a line. Any grid line not otherwise designated, is assumed to be a secondary road. Secondary roads cost three times as much to travel along as major highways.

2. Development

Each parcel may be developed by the team owning it in one of the nine uses shown in Figure I. Only one land use per parcel is allowed. An HI1 may be upgraded to an HI2 by paying the difference in their construction costs. Likewise, an R1 may be upgraded to higher density levels.

A parcel may not be developed unless it is served by utilities on at least one side. The extension of utilities is a public decision made by the majority of teams. All utilities must be connected in a continuous line to the utility plant.

3. Steps of Play

After receiving the $100,000 initial capital, teams (that are identified by letters A,B) perform a number of operations during each round of play in the order specified.

1) Assess real property (Land and buildings are assessed at purchase prices).
2) Receive income for Basic Industries (HI1 receives $22,000 and HI2 receives $48,000 per round if they have all required employees).
3) Pay employed R1's. (Each employed R1 receives $6,000)
4) Pay PG, PS, and BG (These establishments receive income based upon the number of customers they serve).
5) Pay transportation costs. (This money is paid to outside business interests).
6) Pay taxes. (Taxes are the product of the established tax rate of the previous round and the assessed value of land and buildings).
7) Set tax rate. (Majority decision of teams).
8) Buy and sell land. (3 bids per team per round are accepted with land ownership going to the highest bidder. Minimum bid is $1000 per parcel)
9) Provide utilities. (Majority decision by teams. (2000 for construction and $1000 for annual operation of each line).

10) Construct or demolish buildings.(Demolition costs are 1/4th of construction costs).
11) Designate place of employment. (Employer and employee make ageements).
12) Set prices in FG, PS, and BG establishments.
13) Sign trade agreements. (Buyers and sellers make agreements).
14) Receive interest (5% of cash on hand).

Steps 1-7 are not applicable in round #1. Initial play begins, therefore, on step 8.

4. Employment and Shopping Agreements

Pl's will normally agree to work at employment locations that minimize their transportation costs since salaries are not variable.

Customers will normally agree to shop at establishments that minimize the total cost of buying (the purchase price plus transportation to the establishment). Customers will purchase from outside establishments if no local establishment offers an attractive enough price. An establishment may set only one price per type of customer.

Table I.- Unit Characteristics (in thousands)

CHARACTERISTIC	TYPE OF UNIT								
	HI2	HI1	BG	PG	PS	R4	R3	R2	R1
Basic Construction Costs [a]	96	48	36	24	24	72	48	30	12
Income per round[b]	48	22	12	12	12	24	18	12	6
#of employees working in	4	2	1	1	1				
#of employees living in						4	3	2	1
Approx. population represented						16	12	8	4
Payroll expenses	24	12	6	6	6				
Max. shopping cost at PG						8	6	4	2
Max. shopping cost at PS						4	3	2	1
Max. BG costs	4	2		1	1				

a) See Table II. for reduced construction costs due to specialization

b) Incomes for BG, PG, and PS are based upon an estimated break-even market area; i.e., 6 residential units for an PG, 12 residential units for a PS, or 3 industries for an BG.

Table II. - Reduced Construction Costs due to Specialization (in thousands)

Unit to be Built	HI2	HI1	BG	PS	PG	R4	R3	R2	R1
1 st	$96	$48	$36	$24	$24	$72	$48	$30	$12
2nd	90	48	36	24	20	72	48	30	12
3 rd	85	48	36	20	18	72	48	30	12
4th	80	48	36	18	18	67	45	28	11
5th	80	48	36	18	18	67	45	28	11
6th	80	48	36	16	16	67	45	28	10
7th	75	48	36	16	16	62	42	26	10
8th	75	48	36	15	15	62	42	26	10
9th	75	48	36	15	15	60	40	25	10
10th	75	48	36	15	15	56	38	23	9

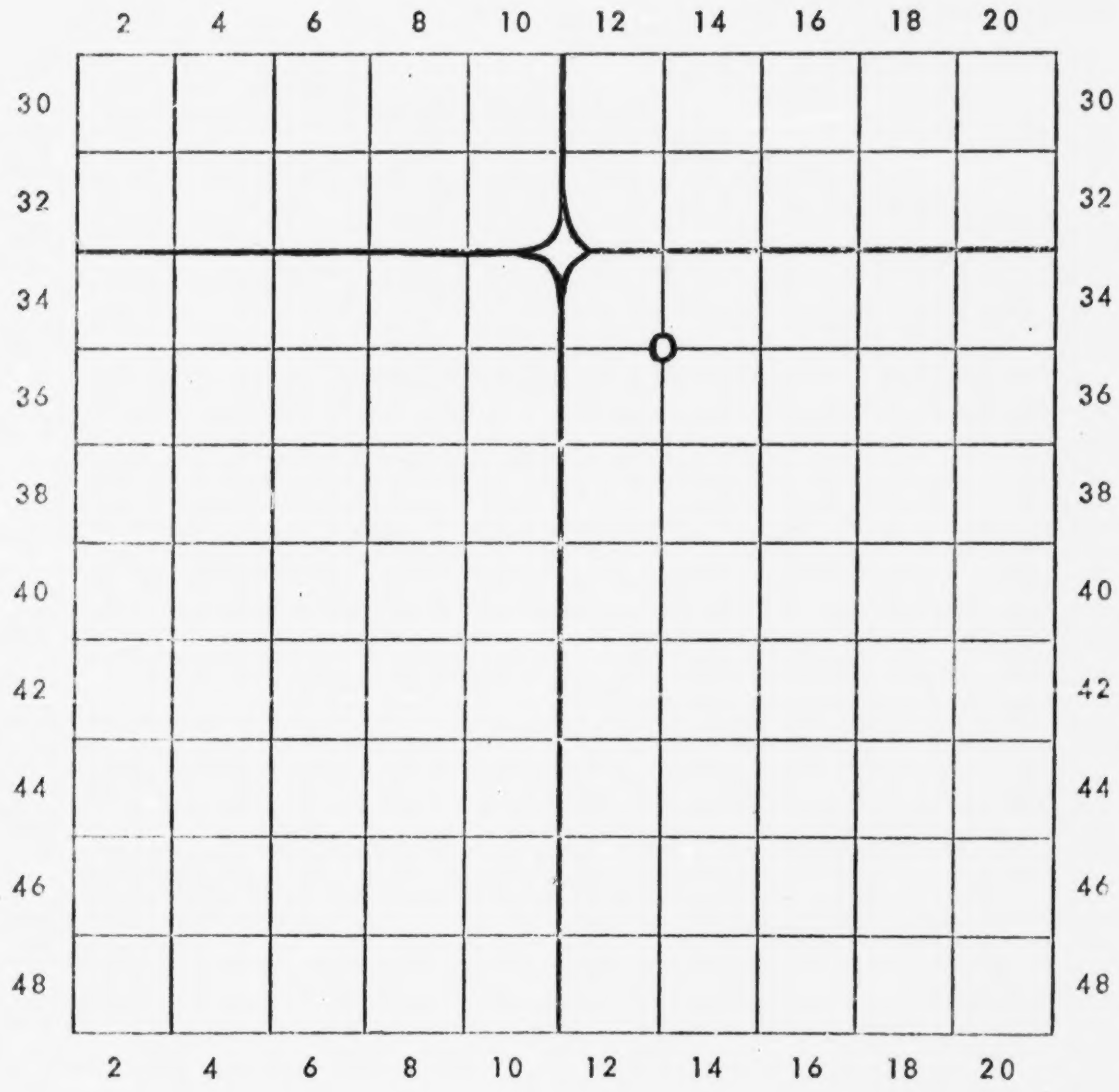
Table III. - Transportation Costs Between Units (per mile of travel along best road type)

Type of Unit Traveling	Type of Unit as Destination					
	HI2	HI1	BG	PS	PG	Terminal
HI2			$400			$4000
HI1			200			2000
PS			100			
PG			100			
R1(for shopping)				$100	$200	
R1(for working)	$300	$300	300	300	300	

CLUG PLAYING BOARD

◇ = TERMINAL

O = UTILITY PLANT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APPENDIX B

RESEARCH PAPERS

The students were obliged to write a research paper of their own choosing. To give the students some food for thought, the following research topics to think about:

List of Suggested Term Paper Topics

1. Build starting points for selected cities.
2. Scrapbook of newspaper articles on the city and describe how these relate or do not relate to the model and the course.
3. Flow chart the model in layman's terms
4. Develop a set of urban indicators from the statistics available in the model.
5. Act as the city historian or newspaper and catalog the rounds of play.
6. Design manual modules to add to the model (air pollution, water pollution, solid waste, crime, race, legal system, political system, etc.)
7. Prepare 10 years of decisions to bring the 1960 D.C. metropolitan model up to its 1970 status.
8. Examine the parameters of the model in light of statistical studies and other models of urban areas.
9. Examine the theory implied by the model (micro-macro, production, finance, etc.)
10. Make a thorough review of a major book on the urban system.
11. Develop a set of economic indices that reflect growth, development, financing, urban prices and other factors.

Several of these topics merited special comment, since they had proved successful in my previous two courses in the simulation of urban systems.

The assignment to choose a real city, find data for it and arrange the data to represent a new load configuration for the model had been a most worthwhile exercise for the students of earlier courses. There is probably no better way for a student interested in the problems of data availability and model parameter fitting to gain some first hand experience in these two fields. The CITY MODEL is broad enough in scope so that it allows the student a wide range of data sources to be explored. However, the student may choose any number of levels of sophistication and thereby make the task one that takes a period of time ranging from a week up to several weeks.

Becoming the city historian is a research paper assignment that has benefit not only for the student doing it, but also for the class as a whole. This particularly is true if the student starts his assignment early in the play of the model and summarizes the state-of-the-city at the start of each round.

Another assignment which forces a student to understand the urban environment in systems terms is that of designing and, possibly, implementing a manual component to add on to the CITY MODEL. For example, the addition of a manual air pollution component would force the student to relate the causes of pollution to activities in the model (utilities, factories, transportation, etc.) and simulate the effects of air pollution on the system (health, cleaning costs, weather changes, etc.).

The following is a list of the research papers actually chosen by students in the class:

1. Blue City: Georgetown (An Analysis of the Run of the Model) by Bob Reid.
2. Bus Company Optimization Procedure by Patrick Mulvanny
3. Critique of Forrester's "Urban Dynamics" by Wilfried Ver Eecke
4. Economic Assumptions of the CITY MODEL by Janice Decker
5. Madison, Wisconsin by Mark Meiners
6. Chicago, Illinois by Patrick Quinn

7. Analysis of Factors Affecting Urban Transportation Modal Split: With Application to a Model for Washington, D. C. by Daniel Hecker

8. An Approach to Optimize the Size and Location of Planned Communities by Ted Hume

9. A Review of the 14th Street Urban Renewal Project by Michael Finnegan

A brief description of the first five of these research papers will be given now to provide some flavor for the type of research performed and how it related to the CITY MODEL.

Bob Reid was elected Chairman in Round 4 in an uncontested election. Simply put, he sought power whereas no one else did. From this pivital position Bob took advantage of his power over the budget and departmental appointments to exercise a strong influence over the play. He described the play in some detail. The following are some of the highlights.

On the play of the Social Sector:

> "...a social act is whenever the society acts separately from its spokesman, the government. In this context, I believe the record must show that there were no social decisions made by our community."

In response to his State of the City Report:

> "Although this tendency to ignore the Chairman's State of the City Report was quite evident during Rounds 3 and 4, the opposite was the case for the second Report ... it had its desired effect."

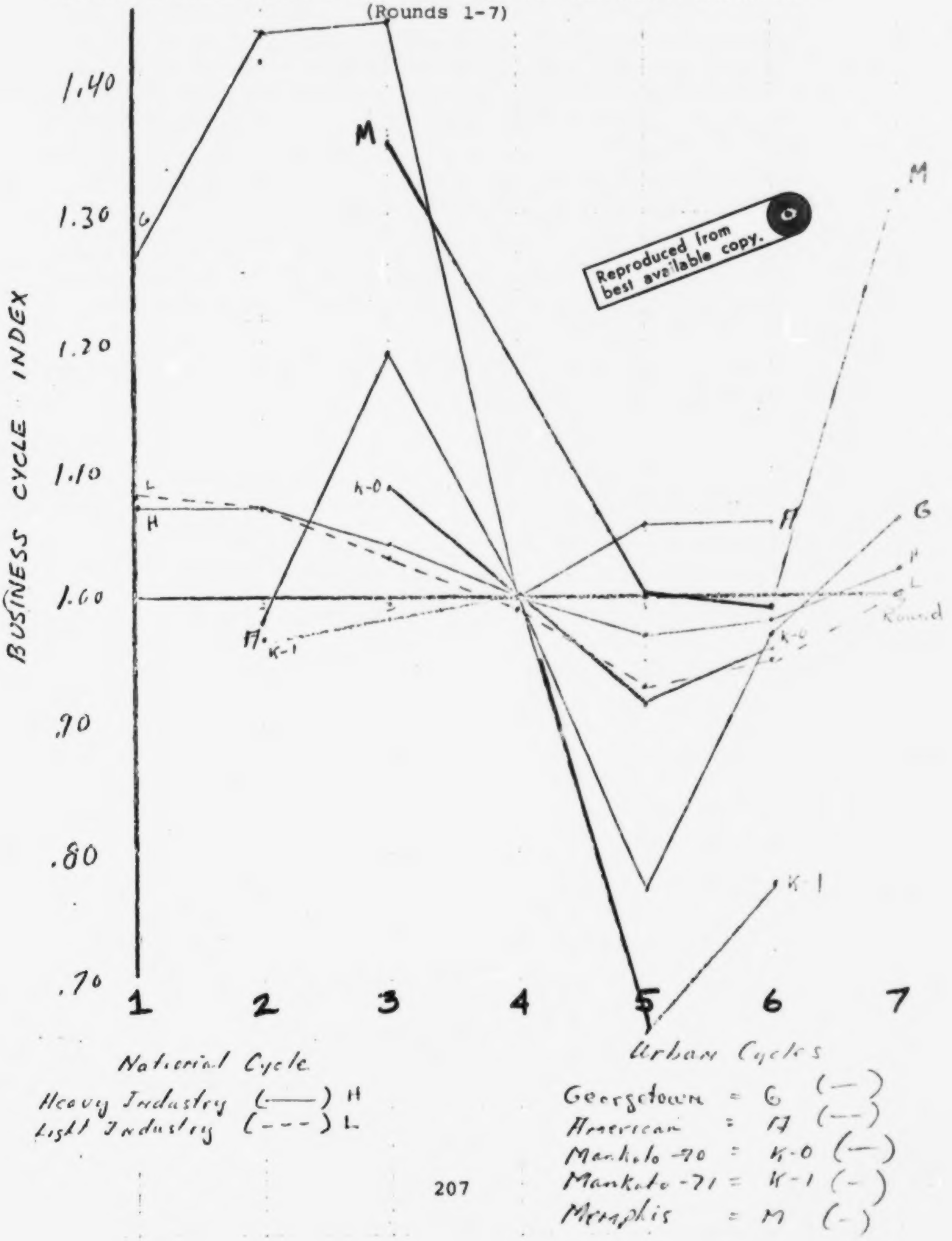
On the economic dynamics:

> "Construction and land speculation began at a furious pace -- a pace only matched by the following rate of return on capital, an event that could have easily been predicted from the marginal efficiency of capital schedule."

Bob calculated what he called the "Urban Business Cycle" which was derived from the comparison of the federal corporate profit tax paid (on the Summary Economic and Demographic Statistics output) to the dollar value of private capital invested in the local system (the sum of assessed value of development times the reciprocal of the assessed valuation rate). Bob then compared this cycle for Georgetown with the same cycle calculated for several other NSF cities (Mankato State 70 and 71, Memphis State and American) and with the cycle for HI and LI. The results are in Figure C-1. Note that each local cycle tends to be more severe than the national cycles.

FIGURE C-1

BUSINESS CYCLE INDICES FOR THE LOCAL AND NATIONAL ECONOMIES
(Rounds 1-7)



Reproduced from best available copy.

Bob used his access to computer output from the other NSF cities to make several other comparisons that helped spur the Georgetown city decision-makers to look at themselves as being in competition with other cities within a national system.

The high per capita personal incomes for Georgetown (shown in Figure C-2) are more a reflection of the acute labor shortage that existed in that city than a reflection of a humanitarian group of employers. In fact, Bob developed another index that measured the extent of labor shortage and showed how this was compared with the per capita income changes.

A final comparison was made among the dissatisfaction levels of the cities (Figure C-3).

FIGURE C-2

PER CAPITA PERSONAL INCOME

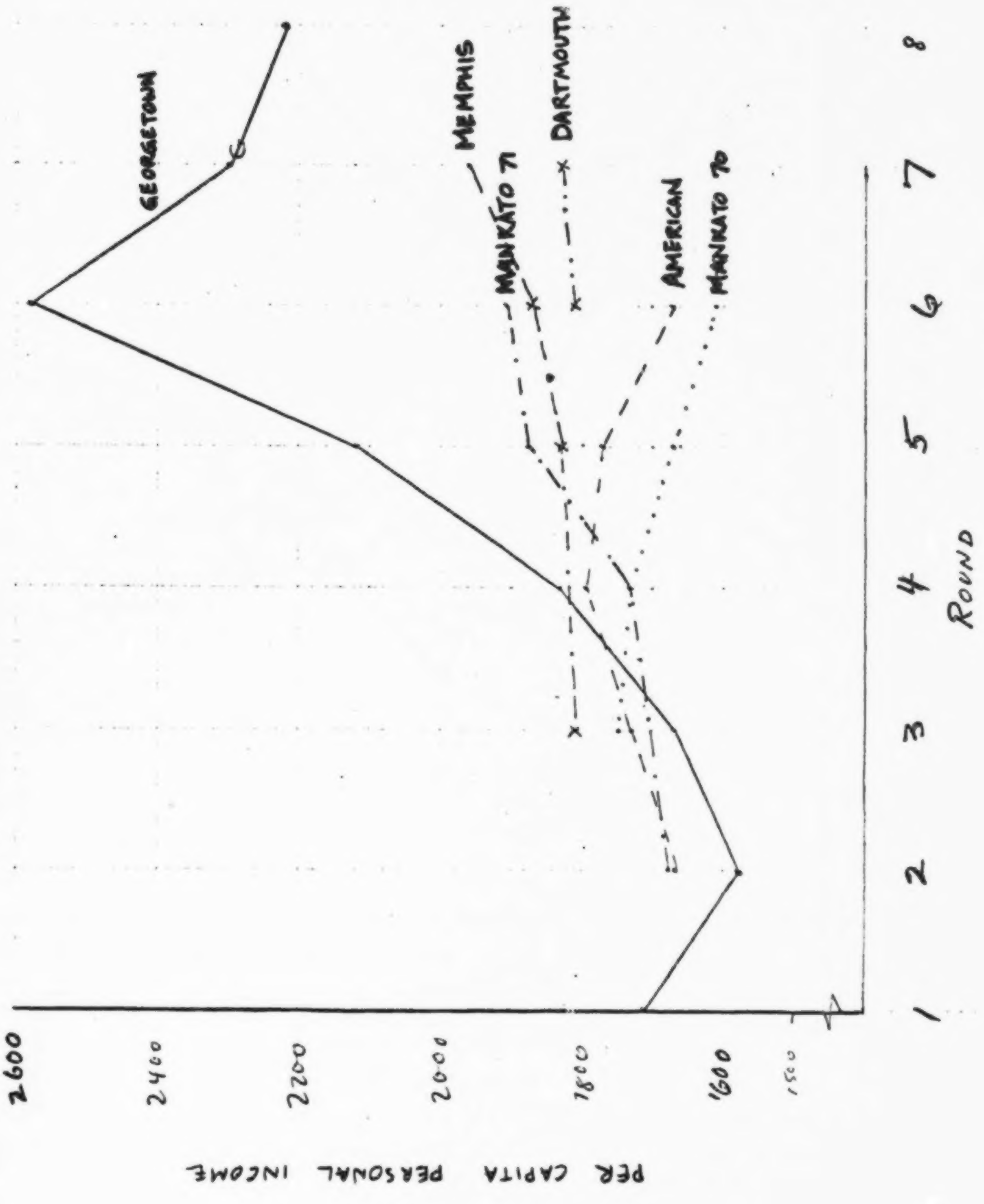
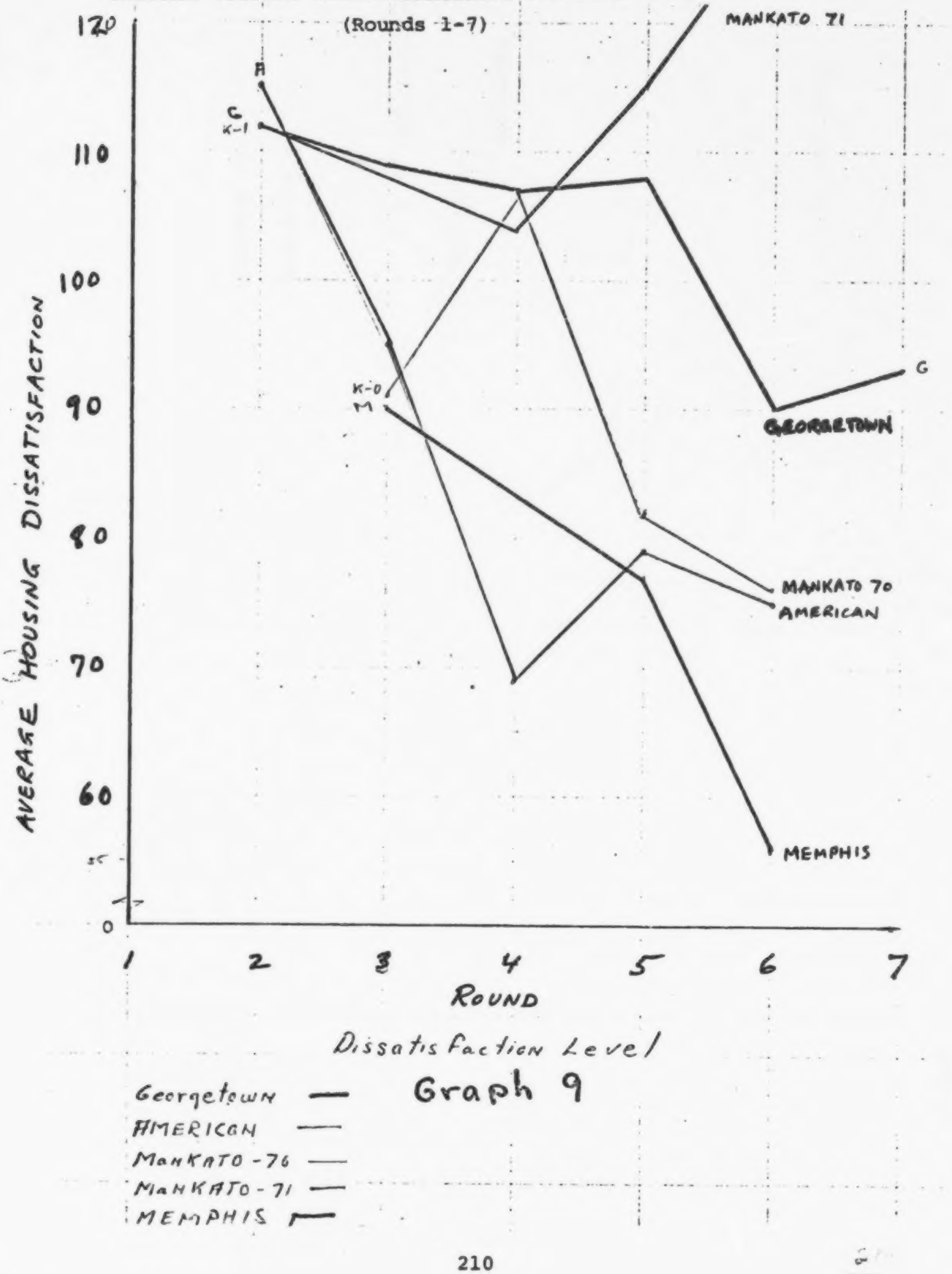


FIGURE C-3

AVERAGE HOUSING DISSATISFACTIONS FOR FIVE CITIES

(Rounds 1-7)



Dissatisfaction Level

Graph 9

Patrick Mulvanny performed what is to my knowledge the most intensive bit of research with regard to the CITY MODEL. After spending several frustrating rounds as the director of the Georgetown city bus company, Pat set out to develop an optimizing procedure for operating (setting routes and fares) the buses for the local system. The key to his analysis is the clever way he used the Employment Selection Information (the employment details) to see who the potential bus riders along each potential one mile route would be.

Starting with the employment details that show the route and mode by each P1 employed at a job other than for schools, MS or bus, and with the dollar value of times as set by the social sector, Pat calculated a "switch point" (the maximum fare per year that could be charged and still allow the worker to choose to take a bus) for each employment grouping on a parcel (see Figure C-4). Following this procedure, a maximum revenue for each mile segment of bus service can be calculated and associated with a given fare. Then one mile segments that do not pay can be dropped in a sequential fashion and a final uniform fare established. Although the procedure would require a computer to assist in its operation, the concept is clear and the reader learns a great deal about the strengths and weaknesses of transportation in the CITY MODEL by studying the paper.

APPENDIX C

READING REPORTS

(Spring 1971)

Three reading reports are due during the semester.

On one single-spaced typewritten page, describe one reading from each of three major sectors: Systems, Models, and Games. As a conclusion to each report, list at least one thing you liked about the reading and at least one thing you disliked about the reading.

All reports will be xeroxed on the date they are due and handed out to all other people in the seminar. Type your name at the end of the report and indicate with the following code your recommendation of the reading to your fellow seminar members.

1. Definitely should be read
2. Is of interest
3. Don't bother

The readings are listed within the three major sectors under two categories: A and B. The B readings are longer and more difficult to complete. Don't chose a difficult reading unless you have the time to devote to it. Although the reading reports will be graded, keep in mind that the major purpose of this exercise is to expose ourselves to a portion of the literature in these fields. If you have any readings you think should be added to the list, please suggest them.

The due dates are:

1. Systems Report - March 3
2. Model Report - March 17
3. Gaming Report - March 31

Reports may be handed in anytime prior to these dates.

SYSTEMS READINGS

Class A (Short)

1. Brian J. L. Berry, "Cities as Systems Within Systems of Cities," 22 pages
2. Kenneth E. Boulding, "The Economics of the Coming Space Ship Earth," 11 pages.
3. "Notes on Complex Systems," from Jay Forrester, Urban Dynamics, MIT.
4. Anthony James Catanese and Alan Walter Steiss, "The Search for a Systems Approach to the Planning of Complex Urban Systems," Plan, April, 1969, 13 pages.
5. Bertran M. Gross, "The City of Man: A Social Systems Reckoning," 21 pages.
6. William F. Hamilton II and Dana K. Nance, "Systems Analysis of Urban Transportation," Scientific American, July, 1969, Vol. 221, No. 1, 9 pages
7. Kenneth E. Boulding, "General Systems Theory - The Skeleton of Science," from Walter Buckley, Modern Systems Research for the Behavioral Scientist, Aldine, 8 pages.
8. John H. Rubel, "An Urban American Report on Business in Urban Development," 20 pages

SYSTEMS READINGS

Class B (Long)

1. Garrett Hardin, "The Cybernetics of Competition: A Biologist's View of Society,"21 pages
2. J. Brian McLoughlin, "Urban and Regional Planning," Frederick A. Praeger Publishers, 310 pages.
3. F. Kenneth Berrien, "General and Social Systems," Rutgers University Press, 204 pages.
4. Locational Analysis in Human Geography, Peter Haggett, London: Edward Arnold Publishers Ltd., 27 pages
5. Walter Buckley (editor), Modern Systems Research for the Behavioral Scientist, Aldine Publishing Co., Chicago, 30 pages (selected pages)
6. Donald F. Blumberg, "The City as a System," Decision Sciences Corporation, 50 pages

MODEL READINGS

Class A (Short)

1. Locational Analysis in Human Geography, Chapter 1 "Assumptions." Peter Hagget, 27 pages.
2. "The Pittsburgh Urban Renewal Simulation Model." William Steger, 6 pages
3. "A Short Course in Model Design," Ira Lowry, 8 pages, AIP, May, 1965.
4. "Computer Simulations, Physio-economic Systems, and Intra-regional Models," John Kain and John Meyer (AER May 1968), 16 pages
5. "Computer Simulations in Urban Research," John Crecine, PAR, 11 pages
6. "Regional Economics: A Survey," John Meyer, 41 pages, AER
7. "The Uses of Theory in the Simulation of Urban Phenomena," AIP, September, 1966, Britton Harris, 15 pages.

MODEL READINGS

Class B (Long)

1. Bay Area Simulation Study (San Francisco), Center for Real Estate and Urban Economics, 447 pages.
2. A Model of Metropolis (Pittsburgh), Ira Lowry, 136 pages.
3. A Probabilistic Model for Residential Growth (North Carolina), Thomas Donnelly, et.al., 65 pages
4. Factors Influencing Land Development (North Carolina), F. Stuart Chapin, Jr. and Shirley F. Weiss, 101 pages.
5. A Dynamic Model of the Economy of the Susquehanna River Basin, Battelle Memorial Institute, 250 pages.
6. Urban Dynamics, Jay Forrester, 285 pages.
7. San Francisco Community Renewal Program, Arthur D. Little, Inc., (excerpts) 45 pages
8. A Model of Residential Land Values, E. F. Brigham, 91 pages
9. Urban Performance Model, Planning Research Corporation, 51 pages
10. Design and Use of Computer Simulation Models, James R. Emshoff and Roger L. Sisson, MacMillan Co., 1970, 302 pages.
11. Regional Development and Planning (entire issue of AIP, May, 1964), 100 pages.

GAMING READINGS

Class A (Short)

1. Allan G. Feldt, "Operational Gaming in Planning Education," American Institute of Planners, January, 1966, 7 pages.

2. Richard L. Meier and Richard D. Duke, "Gaming Simulation for Urban Planning," American Institute of Planners, January, 1966, 14 pages.

3. Herbert W. Fraser, Simulation and Game Approach to the Teaching of Economic Principles, A Preliminary Report, Washington University, 19 pages.

4. James S. Coleman, Games as Vehicles for Social Theory, The American Behavioral Scientist, 5 pages.

5. Simulation Games for the Social Studies Classroom, New Dimensions, An FPA School Services Publication for Teachers, 47 pages.

6. John L. Taylor and Kenneth R. Carter, Instructional Simulation in Urban Development: A Preliminary Report, 20 pages.

7. Allan Feldt, Some Thoughts and Speculations on the Development and Use of Games in Teaching and Research, 6 pages.

8. Harold Guetzkow, Simulation in Social Science Readings, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 36 pages.

9. Erwin Rausch, The Community, Science Research Associates, Chicago, Illinois, 1968. 22 pages with worksheets.

10. Norton Long, The Local Community as an Ecology of Games, November, 1958, 12 pages.

11. Peter House and Philip Patterson, "An Environmental Gaming Simulation Laboratory," AIP, November, 1969, 6 pages.

12. Ellen Berkeley, "The New Gamesmanship," Architectural Forum, December, 1968, 6 pages.

GAMING READINGS

Class B (Long)

1. Kalman J. Cohen, William R. Dill, Alfred A. Kuehn, and Peter R. Winters, The Carnegie Tech Management Game -- An Experiment in Business Education, Richard D. Irwin, Inc., Homewood, Illinois, 1964, 55 pages.
2. Hans B. Thorelli and Robert L. Graves, International Operations Simulation, The Free Press of Glencoe, Collier-MacMillan Ltd, London, 391 pages.
3. William A. Gamson, SIMSOC -- Simulated Society, The Free Press, New York, 29 pages -- Instructor's Manual.
4. William A. Gamson, SIMSOC -- Simulated Society, The Free Press, New York, 108 pages - Players' Manual
5. Annual Report to the Ford Foundation, December, 1968, Computer Equipment for Urban Research and Training -- The M.E.T.R.O. Project. The University of Michigan, School of Natural Resources, Ann Arbor, Michigan.
6. John R. Raser, Simulation and Society -- An Exploration of Scientific Gaming, Allyn and Bacon, Inc., Boston, 159 pages.
7. Roger Caillois, Man, Play and Games, (translated from the French by Meyer Barash), The Free Press of Glencoe, Inc. 202 pages.
8. Selwyn Enzer, Theodore J. Gordon, Richard Rochberg and Robert Buchele, A Simulation Game for the Study of State Policies, The Institute for the Future, Middletown, Connecticut (September, 1969), 69 pages
9. Barry Lawson, New Town - An Urban Land Use and Development Game, Instruction Booklet, 1969, 49 pages with illustrations.
10. Hans B. Thorelli, Robert L. Graves, and Lloyd T. Howells, INTOP Players Manual, "International Operations Simulation," The University of Chi ago, The Free Press, 1963, 55 pages.
11. The Northeast Corridor Transportation Game, Vol I, Planning Simulation and Administrator's Manual, ABT Associates Inc., Cambridge, Massachusetts, July, 1968. Prepared for the Department of Commerce, National Bureau of Standards, 89 pages.
12. Venture, Business Simulation Exercise, The Proctor and Gamble Co., Cincinnati, Ohio, 86 pages with illustrations.

Gaming Readings - Class B (Long) - Continued

13. APEX: A Gaming Simulation for Air Pollution Experience in a Simulated Metropolitan Environment, Richard Duke, December, 1968, 100+ pages.

Chapter IX

"CITY MODEL" USAGE IN THE URBAN STUDIES INSTITUTE

of

Mankato State College

by

Robert A. Barrett

"CITY MODEL" USAGE IN THE URBAN STUDIES INSTITUTE

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"City Model" Usage in the
Urban Studies Institute
of
Mankato State College

by

Robert A. Barrett*

The "City Model" was utilized in the interdisciplinary program in Urban Studies at Mankato State College in two formal courses which I instructed and one independent study course which the students organized. This utilization during the 1970-1971 academic year was sponsored by the college and Envirometrics as part of an NSF project to test the applicability of the "City Model" in selected disciplines and academic institutions. The experimentation reported upon in this chapter proved to be an absorbing and rewarding experience to both the students and the instructor.

Introduction

My first experience with urban simulation came when Dr. Royce Hanson, director of the Washington Center for Metropolitan Studies, introduced me to the urban simulation lab which the Center had established under the direction of Dr. Peter House. I was afforded an opportunity to experience some "rounds" of the game and met some of the lab staff members. I became quite intrigued with the potential of the urban simulation lab to provide opportunities for theory building and concept testing in the urban studies curriculum.

---

*Dr. Robert A. Barrett is Director of the interdisciplinary Institute for Urban Studies and Professor of Political Science. Mr. Frederick Sauer provided valuable assistance in the accomplishment of this experiment.

My own academic training had focused first upon the sciences and then the social sciences leading to graduation from Hamline University in St. Paul with a double major in Social Science and Mathematics. When I joined the graduate program as a fellow in government and public administration at American University I was strongly interested in Political Science. My interests began to focus upon the city and its politics as I worked closely with my major advisor, Royce Hanson. These interests grew when I entered college teaching as a member of the faculty at Mankato State College, a regional institution in Southern Minnesota with an enrollment of 15,000 graduate and undergraduate students.

My early interests on the Mankato State faculty were twofold: to introduce significant opportunities within the Political Science curriculum for the study of cities and to work with sister disciplines, particularly the social sciences, to organize an interdisciplinary degree program in Urban Studies. The first interest was realized through the adoption by the Political Science Department of courses such as Urban Government, Urban Planning, Urban Administration, Urban Seminar and field study and internship experiences in the urban environment. The second interest matured into a healthy dialogue and collective action by several disciplines whereby our disciplines were married together into a B.S. and M.A. degree program for urban generalists seeking urban planning and urban management careers. More than two dozen faculty from over one dozen disciplines now cooperate on a refreshingly interdisciplinary scale to teach and research topics in Urban Studies in the Urban Studies Institute. The students in this program, numbering about 150, are upper division and graduate students whose previous experience has largely been in the social sciences. Furthermore, our students' background has typically been textbook oriented without substantial experiences within an urban environment. Consequently, our efforts to provide realistic urban learning environments through intensive field study camps and internship work experiences found a natural learning complement in the use of the urban simulation lab.

The Course

The "City Model" was utilized within the framework of two of the core courses of the Urban Studies curriculum. The first course was the Urban Studies Seminar which is offered to senior and graduate majors after they have completed a series of discipline based courses in the social sciences. The course is taught from an interdisciplinary approach with small enrollments (8 to 15 students) and with an emphasis upon analysis and discussion. In the seminar the class alternated use of the game with seminar meetings focused upon research and analysis of New Towns as an approach to the city as a system. The second course was Urban Government which is offered to junior/senior and graduate majors and non-majors who are interested in contemporary governmental and political problems of metropolitan areas. This lecture course generally enrolls a moderate number of students (30 to 40). and is taught from the Political Science discipline. In this course the game was alternated with conventional lectures which surveyed the standard topics of contemporary urban government. Selection of these courses for use with the "City Model" was largely a factor of the course schedule and the previous course work backgrounds of students enrolled in these courses. Whereas these courses had been partially redesigned at the outset, it became obvious during the conduct of these courses that not only the methods but also the objectives required serious modification. Consequently, I discovered that the usage of urban simulation required not only a rearrangement of the course syllabus but a major adjustment of the course objectives of these courses which had originally been developed to be taught with more conventional instructional techniques.

The primary objectives for the use of "City Model" in these courses were several. In the first instance, it was hoped that the model would afford a more multi-dimensional understanding of the city as a system. It was hoped that theory building and concept testing would be encouraged and would take place within an experimental context. For instance, concepts of decision-making and community power are capable of close observation and testing in the game dynamics. It was anticipated that the dynamics of negotiation, representation, advocacy, and related "role" activities would be meaningful and insightful experiences. A further objective was to sharpen the analytical capabilities of the class participants. Finally, the use of the game was to be tested as an effective learning experience within the established Urban Studies curriculum.

The course described in this chapter is the Urban Government course with an enrollment of 35 senior and graduate students majoring in Urban Studies or Political Science. The course was scheduled to meet one afternoon a week for three hours and the instructor received continuing assistance from a graduate assistant. The game was played on alternate weeks with an analytical and strategic discussion taking place during those alternate weeks when the game was not played. The following table illustrates a typical two-week schedule:

Table I

Schedule of Course Activities

A. Week I	
Time	Activity
30 minutes	Course assignments, general discussion.
30 minutes	Distribute results from last game round, cite highlights and trends, players record progress toward individual objectives.
30 minutes	Players analyze progress, revise role objectives, formulate strategies.
60 minutes	Players negotiate with government, economic and social sectors to maximize progress towards stated objectives.
30 minutes	Players complete decisions, write out decisions and report to game director.
B. Week II	
120 minutes	Course lecture and discussion.
15 minutes	Distribute "BLUECITY GAZETTE" and "PEOPLE'S ADVOCATE".
45 minutes	Hold "town meeting" to discuss and analyze progress in game and relate game to course objectives.

The above schedule varied for purposes of the introductory session, examination periods and other related coursework. In retrospect, it would have been more advantageous to have the course meet twice weekly for two or two and one-half hours each meeting so that the participants would have shorter elapsed time intervals. In the intervals between the meetings described above the graduate assistant edited the "newspaper", prepared computer input and output, developed visual presentations and assisted the players. The players held numerous informal meetings for strategy and analysis and were generally infected with a high level of interest and enthusiasm.

Organization of Players

At the initial class meeting the students decided who should be mayor and then self-selected their role in the social sector or economic sector. Hence, each of the students became a player in one of the three sectors.

The government sector of Blue City were structured after a commission form of local government whereby the government officials were both council members and department commissioners. The structure was devised more for the purpose of convenience relative to the limited number of players than for a desire to structure some "desirable" form of local government. The government participants were as follows: the Mayor, Transportation Commissioner, Planning and Zoning Commissioner, Education Commissioner, and the Public Works Commissioner.

The Mayor was elected by a simple majority of the class participants. Each candidate gave a platform speech indicating his or her respective objectives for Blue City as well as the intended short and long-range plans. After the election of a "liberal" mayor for the city, he then selected his staff of commissioners. The Mayor's responsibility consisted of overviewing the general administrative policies for the city as well as directing the publication of the _People's Advocate_ newspaper. The _People's Advocate_, as opposed to the _Blue City Gazette_, was a government publication. It assumed the role of indicating the "accomplishments" of Blue City to the public as well as future goals and plans. It may be interesting to note that the opinions expressed in the _People's Advocate_ and the _Blue City Gazette_ varied considerably. The Mayor, at numerous meetings, characterized the _Blue City Gazette_ in terms of "yellow journalism".

The responsibilities of each commissioner were as follows: the Transportation Commissioner assumed the role of overseeing the building, maintenance, and administrative activities of roads, bus and rail. The Planning and Zoning Commissioner was responsible for assessment and zoning activity of Blue City. The Education Commissioner was responsible for the building, maintenance and locatio of public, private and vocational schools. The Public Works Commissioner directed the building and maintenance of municipal services and utilities.

The Economic teams, by virtue of their assigned responsibilities, had a greater degree of influence than did the Social teams with respect to influencing the growth of Blue City. The assigned responsibilities of the Economic decision makers involved bidding on and/or purchasing land or developments; changing rents, prices, salaries and maintenance levels: transferring cash; lending, borrowing and investing capital; and building, upgrading or demolishing developments. Ir was found preferable to have at least two participants for each Economic team. With a limited number of participants, it was also determined that Economic teams should consist of more participants than the Social teams.

The assigned responsibilities of the Social teams involved voting, boycotting, time allocation, and setting the dollar value of time. Apart from the assigned responsibilities to the Social decision-makers from the manual, it was determined that the Social teams should have a greater degree of political influence. A simple majority of the Social decision-makers could recall the mayor and provide for the election of a new mayor, and they were also given a "veto" role through the referendum over certain bond and zoning decisions.

The Blue City Gazette reported statistical city data from one round to the next as well as editorialized on the activity of the Mayor and his staff. It was found that the Gazette afforded the class participants a vehicle for assessing the development of Blue City. The People's Advocate offered a basis of comparison between the statistical data as well as the Mayor's own interpretation of the data. The use of "newspapers" was found to be an effective communications link between the various sectors and also aided the student's comprehension as to "What is happening to our city?"

GAME RESULTS

At the outset of the game each of the players was required to formulate an explicit set of objectives for his sector and his role. Once during the term he revised these objectives in light of experience and changed attitudes. At the close of the term he analyzed his own rounds of play as to how well he achieved his objectives and what factors contributed to his success and failure. Likewise, he evaluated the performance of Blue City as a system and as a learning experience. A review of the results of the student's experiences is most revealing.

In the government sector the Mayor and his Commissioners had wished to first increase the supply of jobs in construction and manufacturing to lower unemployment. One method used to accomplish the objective was to grant public subsidies to private housing construction and manufacturing industries. This objective was met in part during the last round when 80 new jobs were created. Unemployment dropped from its highest level of 8,760 workers in round three to zero unemployment in round six. This was largely attributed to new construction which offered new jobs of major impact for the unemployed.

The second objective of the government sector consisted of providing a higher standard of living for the poor. The criteria for a higher standard of living for the poor was to raise the welfare payments from $1,500/family/year to $2,500/family/year. This was done by round six which was the last round the first Mayor held office. Rounds seven, eight, and nine, however, reflect a decreased welfare payment to $1,600/family/year which was a different policy by the new Mayor in the second quarter of play.

A third objective of the Mayor was to increase the supply of housing for low income families, particularly in the northeast section of Blue City. The demographic map, however, indicated little or no increase in housing for the northeast section.

A fourth objective of the Mayor was to increase public participation by holding town meetings on local issues and by the publication of a newspaper called The People's Advocate. Town meetings were held during each class session. The Mayor, however, seemed to find a great deal of opposition to several issues, most of which are reported in the Blue City Gazette, copies of which appear in the Appendix. One issue of considerable debate, particularly from the Economic Sector, involved the Mayor's policy to increase welfare payments. The Economic Sector thought it more advisable to increase the quality and quantity of public utilities which would assist in the development of new construction which would provide the needed jobs. As was noter earlier, welfare payments were increased. A recall election was then held as a result of the wishes of the Economic Sector. The Mayor won reelection by three votes and he termed his victory to be a "clear mandate".

The objectives of the Commissioners of the Mayor's departments were numerous. The Transportation Commissioner wanted to increase the number of bus routes. This objective was not realized because of bureaucratic red tape and procedural errors. The Commissioner once unsuccessfully attempted to establish a bus route through a farmer's corn field. The Planning Director's objective was thwarted when agreement upon a comprehensive plan was not obtained. The Education Commissioner wanted to improve the quality of education but continually found populated areas without established school district boundaries. It was also found that the average educational level decreased from an index of 60 in round one to 57 in round six. At the same time, the student-teacher ratio increased from 14 to 15. The Commissioner of Public Works wanted to build a new utilities plant to provide for expanded construction but he forgot to transfer monies from the operating budget to the capital construction budget.

Many of the objectives of the Social and Economic Sectors are mutually dependent upon one another as well as the policies of the Government. Social decision makers attempted to increase the educational level, increase employment opportunities, increase voter registration, allocate time more effectively, encourage convenient mass transportation, improve quality and construction of housing, develop additional recreational areas, encourage effective government spending, and develop a "collective spirit for decision making". With reference to the latter objective the Social decision makers were encouraged to meet collectively relative to their recently established power in having the deciding vote on bond issues and major zoning changes.

The objectives of the Economic Sector were essentially self-interest rather than public-interest oriented. The basic criteria for success was economic profit. The primary means attempted to obtain a profit was through land development and construction. The question of conflicting objectives between the Economic Sector and the Social and Government Sectors did not occur relative to the type of construction as originally thought. This could possibly be attributed to the lack of a comprehensive development plan for zoning regulation and development. The basic conflict of objectives that arose between the Economic, Social and Government Sectors was concerned with the way in which tax dollars were being spent. A priority issue of the Mayor's platform was to help the poverty groups in Blue City by increasing welfare payments. This policy took priority over providing additional utility service and large government subsidies to the Economic Sector for utility construction purposes. Without the required utility levels, additional construction was impossible. The Economic Sector argued that building construction would provide jobs for the lower income groups. The Mayor felt that the welfare payments were too low and that the additional costs of raising welfare payments to $2,500 from $1,000 should be the first priority.

Since construction and land development was one immediate economic objective, it was generally felt by the Economic Sector that this objective was not met to the degree that had been projected.

Another economic objective was to bid, buy and develop available land outside the city parameters. This effort was made in an attempt to establish a "New Town" which failed since many of the bids were too low.

Perhaps the greatest value which the "City Model" game possessed for the Economic Sector was the insight gained in the necessary procedures and consequential problems of spending dollars to gain a profit. New construction required the proper zoning, capital investment, the type and availability of land, utility service, road access, and convenient mass transportation. Each step was confronted with either a conflicting or cooperative effort on the part of the Social and Government Sectors.

The Government, Economic and Social Sectors were confronted with a number of frustrations in attempting to meet their objectives. The challenge of the game which coincides with the frustrations is, in itself, a valuable learning experience. The city as a whole did improve considerably through eight years. With a total increase in population of 51%, the total increase in employed workers was 55%. There was a 65% increase in low income workers, 47% increase in middle income workers, and a 56% increase in high income workers. Through four of the eight years there was no unemployment and no welfare expenditures. With public school enrollemnt increasing 17% and private school enrollment increasing 68%, the average educational level declined 9%. The average number of new jobs increased 60% which reflects an expanding community. Although the city initially had an average increase of 120% for outstanding bond payments in the first four years, there were no outstanding bond payments the last four years. The increased development of Blue City was financed with a 28% increase in revenue from taxes, much of which is attributable to an increase in tax-paying population rather than any substantial increase in tax rates.

Concluding Observations

A series of evaluations have been made of the utilization of the City Model game in our Urban Studies curriculum. In the first instance the participants conducted an evaluation of the game which is summarized in the following table with references to advantages, disadvantages and recommendations for modifications.

Table II

Participant Reactions

Advantages

Increased understanding of the role of government personnel and associated "red tape".

A better understanding of the conflicts between the government economic and social sectors in an urban environment bying for a scarce resource and the need for public service.

The City Model Game more closely assimilates a pragmatic urban problem-solving approach than that of a "text book" approach.

Next best thing to job experience.

A situation in which one feels the general frustration involved in attempting to promote change. This necessitates better communication between interests and increases one's understanding of vested interest as well as the cause-effect relationships between government, economic, and social participants.

Disadvantages

Problems in understanding the computer language as they apply to desired decisions.

Lack of formal prerogratives in the social sector in making decisions that would have a greater consequence for the city as a whole. (This was corrected somewhat in giving the social participants new powers.)

The government sector did not establish a clear system of priorities. They reacted more toward the "outside system."

Disadvantages (Continued)

The class was made up of a relatively homogeneous group of college students rather than a representative heterogeneous group that generally live in an urban society.

The time limitation in carrying out long-range programs.

Recommendations

A need for a more graphic display of the city.

More available time should be given to play of the game with several rounds played in one day.

Initiate field trips to local units of government in order to better translate and compare the statistical data of Blue City with an actual urban situation of a similar nature.

Hold town meetings at regular intervals where all class members can participate.

Open up a means for communicating with other schools playing the City Model Game.

Providing the social sector the power to determine the need for bonding and zoning changes through a referendum. This may be a vehicle for the social decision makers to better organize and participate to a greater degree in "role playing". (This was changed for the next game.)

Provide a better understanding of how specific decisions affect the "dissatisfaction index".

Concentrate on the importance of "role playing" prior to starting play of the City Model Game.

The objectives which I had suggested at an earlier point in this chapter were all capable of examination during the utilization of the game. My basic evaluation is highly positive regarding the value of the game as a learning tool. The participants demonstrated a far more sophisticated appreciation of the city at the close of the term. Many standard concepts were applied and hence tested in the game. The existence of conflict and personality became important to the players. Coalition and strategy building exercises were realistic. The frustration and delay of the "real system" became more obvious.

The analytical techniques of the students were tested and improved. The existence of the city with many dimensions and a system was demonstrable. The use of gaming improved the student/instructor relationship and provided an absorbing learning experience for the students. Considerable student iniative was demonstrated, including the continued play of the game on an independent study basis.

From our use of the game it would appear more appropriate to use the "City Model" in an "Urban Systems" or "Urban Simulation" course where it is the primary course method and the course can be developed around the game. It is very desirable to have the game mounted on a computer in close proximity so as to minimize the "turn around" inconvenience. The help of a graduate assistant or student assistant is imperative. I would suggest that the "intellectual payoff" of the City Model is highest within an interdisciplinary course because the game is an excellent interdisciplinary tool whereas for students from only one discipline much of the role-playing is beyond their experience. It would appear that this tool would have greater advantage for advanced students rather than beginning students.

Based upon this experience with gaming in the Urban Studies curriculum, I have concluded that gaming can perform a valuable function within the curriculum. It is an excellent experience for students to test and hypothesize about real urban environment relationships. The dynamics of the game are very revealing. This model permits the urban social scientist to enjoy many of the laboratory experiences which prove to be of strong benefit to the Urban Studies student.

The appendices which follow contain examples of the "newspapers" developed by the students to upgrade communication about the game and selected statistics about the rounds of play of "Blue City".

APPENDIX A

BLUECITY GAZETTE

Vol. 1 Tuesday, January 26, 1971 No. 1

SUPERMAYOR McCARTY ELECTED!

PLEDGES A GOOD LIFE FOR ALL CITIZENS OF BLUECITY!

PLEDGES A GOVERNMENT RESPONSIVE TO THE PEOPLE!

PLEDGES A CHICKEN IN EVERY POT!.

After one year under "Supermayor McCarty and his cronies, BLUE CITY is in a super-mess.

UPI Report: The spotlight of national attention has recently been focused on BLUE CITY, Minnesota. For the past three months, 6,800 welfare recipients have been picketing the office of "Supermayor" McCarty. As reported by one staff member (who would not give his name), "the steps of City Hall have been so crowded the Mayor has not been able to get to his office for three months." It has also been reported that as a consequence of this uprising the Mayor has been conducting his business from what he affectionately calls "Supercar" (the car only uses premium gas).

The uprising from welfare recipients seems to have come about from when the Mayor lowered welfare payments from $1,500 to $1,000 per year. As a consequence, the "average dissatisfaction level index went from '0' to '112'." The Mayor has been unavailable for comment.

EDITORIAL

by

"Star Reporter"

This is not the kind of national attention our city needs! After further digging several unhealthy facts were uncovered about BLUE CITY. Total unemployment went from 4,200 people to 6,800 people - an increase of 38%! All the unemployed were from low income families. This is not a government responsive to all the people. On top of lowering welfare payments, the Mayor established a new tax without letting the citizens know! The new tax is an Employee Automobile Tax that places .01% on people working in the downtown area. One resident was quoted as saying, "The Mayor has done nothing to upgrade the downtown business area. Furthermore, he goes and raises taxes on my car. I think everyone is going to move out of the downtown business district. We'll let the Mayor and his staff work there all by themselves, and then we'll see if they continue the Employee Automobile Tax."

Other facts have also been uncovered. The residents in Square 338 have no school because the Public Works Commissioner, who is in

(Continued on Page 2)

(Continued from Page 1)

charge of public education, forgot to draw the school boundary lines to include this area. One irate mother said, "I would like to know how the Mayor expects us to educate our children when it is the city's job. I think that we are going to picket with the people on welfare!"

The Transportation Commissioner attempted to re-route the bus line, but overlooked the fact that there weren't any streets over the new route. One farmer, while pitching hay, noticed a bus ambling through his cornfield. He said he couldn't believe his eyes, and wondered if the city gave discount rates for chickens, hogs, cows and horses.

The housing situation is unbelieveable poor in the "Nord-East" section of BLUE CITY. New construction and upgrading of housing is badly needed in this section. The population of BLUE CITY has increased from 275,500 to 282,000. There has been no proposal to develop a land use or zoning plan for the city.

With an increase in the city's population, no new jobs have been created. Available new jobs went from zero to zero! The Mayor must establish a policy that will make BLUE CITY a progressive city.

If anyone can find the "Supercar", please call the BLUE CITY GAZETTE. The Mayor should respond to the people - and our problems!

APPENDIX B

BLUE CITY GAZETTE

Vol. 1 Tuesday, February 15, 1971 No. 2

MAYOR McCARTY WINS RECALL ELECTION!

APPOINTMENTS REMAIN THE SAME

The "goo-goos" of BLUE CITY, in their attempt to recall the Mayor and his staff, failed in their efforts. By the vote of twenty to seven, the Mayor was retained. He was quoted as saying, "This is a clear mandate for my programs!" The Mayor, however, was four votes from losing his Supercar.

Perhaps the most devastating decision the Mayor has made is advocating additional bonding for city expenses. BLUE CITY is spending a total of $34.09 million this year for the interest on bonds. This represents almost a 50% increase in interest payments. In fact, BLUE CITY is receiving almost half of its operating capital from bonding - the other half in taxes. If the taxes were raised as this newspaper advocated, we would not be spending the city's tax money paying for the interest on bonds. It would not surprise this newspaper if the Mayor advocated more bonding to pay for existing bonding!

Other statistics that might be of interest to the citizens of BLUE CITY are: Total unemployment went up from 6,800 to 8,760 in proportion to an approximate increase in population (282,000 to 287,500). Furthermore, welfare payments remained the same! No new jobs were created. This could be attributed to a lack of new construction on the part of the Economic Decision Makers. Although construction was attempted, the economic teams either did not have the available resources needed, the level of municipal services was too low, or the decision was written incorrectly. Please refer to the computer printout (a blue X indicates the decisions that were rejected).

The Public Works Commissioner has no available revenue in his Capital Account for utilities. This, in effect, precludes any new construction for utility service. Apparently, the Mayor has not seen fit to allocate his budget accordingly.

The Transportation Commissioner failed in an attempt to build an additional road for the Nord-East section of the city.

There are, however, several enlightening statistics for BLUE CITY. First, the number of low income workers has dropped from 77,500 to 72,000. There has been an increase of medium and high income groups in the city - an increase of 6,000 and 5,000 people respectively. Also, the average dissatisfaction level went down from 112 to 108. Housing quality improved in grids 102-24, 25, and 26, owned by Economic Decision Makers "G", "A", "C" respectively. Good work!! Also, Grid 100-32 improved, and is owned by Economic Team "A".

There is overcrowding in virtually the entire city. Economic Team "D" was the only team that improved their overcrowding in Grid 100-30. Total welfare payments went up to over $1.3 million. BLUE CITY is on the brink of financial crisis. New construction is needed for new jobs which, in turn, brings in additional tax revenue. Taxes must be raised in lieu of new bonding, and the Mayor must establish a rapport with the business community.

APPENDIX C

BLUE CITY GAZETTE

Vol. 1 Tuesday, March 2, 1971 No. 3

MAYOR McCARTY RECOMMENDS GOVERNMENT DOMINATION OF BUSINESS COMMUNITY

EDITORIAL

In a town meeting last week, Mayor McCarty proposed "nationalized government" for BLUE CITY. This would, in effect, bring the business community under the auspices of the Mayor for the purpose of receiving greater financial aid for city activities. Thus, it could also be assumed that business activity and associated priorities would be relegated by the Mayor. The Mayor, when questioned by business community members, commented that Welfare was the number one priority.

The staff of the BLUE CITY GAZETTE stands unanimous in its opposition to the Mayor's proposal. The staff feels the Mayor's proposal is arbitrary and does not reflect a genuine interest for *cooperative* activity between business and government. The social sector has not taken a firm stand and the GAZETTE urges the social teams to reject the Mayor's proposal.

BLUE CITY shows signs of great improvement from the depression of the last three years. In its fourth year, total unemployment went down over 50%. With 8,760 people out of jobs last year, this year's unemployment is 3,400. The following is a breakdown with respect to economic class:

Low Income - 8,400 to 3,400
Middle Income - remained the same
High Income - 360 to zero.

Much of the decrease in unemployment can be attributed to the increased building activity of the business community. The number of new jobs increased from zero to 360. Increased job activity is also reflected in the increased percentage earnings for citizens of the low and high economic classes. Those that earned zero to $5,000 increased from 35% to 38%. Those that earned $10,000 and over increased in number from 17% to 19%. The percentage earnings of the middle class decreased in number from 46% to 42%. The "percentage earning" statistic seemingly defeats the Mayor's espoused philosophy of "the good life" for all residents and an equalization of earnings between classes.

The middle class is by far the most numerous with 113,000 people. The low class has 72,500 people, and there are 109,000 people in the upper economic class with a total population of 294,5000. This is a total increase of 7,000 increased welfare payments and the rising taxes of BLUE CITY. Welfare payments have increased from $1,000 per person to $2,500 per person. The number of persons on welfare, however, has decreased from 8,760 to 3,400 people. The decrease in the number of persons on welfare can be largely attributed to the increased number of new jobs. The tax rate for property tax land improvement was increased by the Mayor from 2% to 7% - an increase of 5%!!!

Tuesday, March 2, 1971

Granted, BLUE CITY has needed additional tax revenue. However, a tax increase on "property land improvement" is not the kind of tax increase the residents of BLUE CITY need for several reasons: First, a tax on land improvement discourages residents from improving their quality of housing. The Mayor has elected to increase your tax when you increase your housing maintenance and improvement. Second, the Nord-East section of the city has poor housing quality. The Mayor's policy of an increased tax on land improvement discourages up-grading the housing in this area.

BLUE CITY'S total revenue has increased considerably because of three reasons: an increase in taxes, an increase in the number of tax-paying residents, and a decrease in bond payments. The Mayor should be congratulated on deciding not to float new bonds. The city's bond payments decreased $18,020,000 from last year.

Generally speaking, the conditions in BLUE CITY improved. The question before the constituency, however, is the way in which the Mayor elects to improve the conditions of BLUE CITY. The average dissatisfaction level went down from 108 to 104. The number of new jobs has increased, and the number of workers receiving welfare has-gone down.

LET's ALL KEEP UP THE GOOD WORK!!

APPENDIX D

PEOPLE'S ADVOCATE Vol. I

1/26/71

SCHOOLS SHOULD PROGRESS UNDER NEW DECENTRALIZED ADMINIATRATION

In keeping with this administration's campaign pledges, we are proud to announce the appointment of Ronald Bellfield as new BLUE CITY Commissioner of Education. Mr. Bellfield finds his new job challenging, and will bring to the office a high degree of competency, having served previously as Commissioner of Schools in New York City.

We have in this decentralization of administrative responsibility new specialized expertise for this critical field.

The policy of this journal will be to keep the public abreast of the activities which government is taking in their behalf and with their participation.

The public officials of your city took the following actions in recent weeks:

The Mayor:

1. Welfare payments were increased by $1,000 per year for each unemployed worker. This begins to give even our unemployed citizens the ability to participate in our growth and standard of living.
2. A small employee's auto tax of 1% was added to pay for welfare, transportation and utilities expansion.

Department of Transportation: (Commissioner G. Roadrunner)

1. A new bus line was established in the N.E. section to enable the mobility needed for that area's residents to take advantage of employment opportunities throughout the city. Also, this will create new opportunities for the residents of the whole city to participate in the civic affairs of the whole city.

Department of Planning, Zoning and Assessment: (Commissioner D. Snoopy)

1. Rezoned parcel 102/22 in the N.E. section of town to recreational use for the establishment of a park. This section was completely without parks and playgrounds before this action.

   Additional tax burden for this action is not anticipated due to pending federal funding to the extent of $50,000, nearly the total cost of development.

Department of Public Utilities and Schools: (Commissioner B. Mouse)

1. Increased utilities in the R3 areas of the city to prevent rent increases for those with fixed incomes. A bond issue was floated to raise the output of the utility plant from level 2 to level 3. This should supply adequate utilities to the areas previously under-served.

2. Applied for a federal grant to provide additional teachers and renewal of the school in the N.E. section.

FUTURE PLANS:

1. A town meeting will be held January 26, at 7:30 p.m. to develop an honest assessment by citizens and government of the problems we have and possible solutions.

The Suggested Agenda:

1. Need for new City Vocational School
   (A committee of citizens have suggested the N.E. section)
2. Incentives needed to get overall favorable business climate established.
3. Highway improvements needed
4. Parks and recreational needs
5. General public school adequacy in BLUE CITY
6. Unemployment

APPENDIX E

THE PEOPLE'S ADVOCATE

Vol. II

February 9, 1971

2nd Round

At the first town meeting held on January 26, 1971, the mayor denounced the BLUE CITY GAZETTE as being totally biased and a good example of "yellow journalism". In addition, he announced that the "paper" is controlled by outside interests much to the disadvantage of his beloved citizens.

Administration's Motto

Those "dirty birds" from the business community who attacked the mayor and administration because of their selfish vested interests will not be tolerated.

BLUE CITY'S administration is for ALL PEOPLE!!!!

MAYOR:

The mayor again showed his big heart for the people when he took the following actions:

1. Set welfare payments at $2,500 per year. This indicates a raise of $1,500 per year for each family without resorting to additional taxes.

2. Subsidized Economic Decision Makers Mr. C. and Mr. E. to give them the opportunity to construct low-cost housing.

3. Subsidized business to develop a manufacturing facility to create new jobs for the unemployed.

PUBLIC WORKS DEPARTMENT:

Mr. B. Mouse, brother of the revolution very modestly announced the following "cool" moves on his part:

1. Contracted for a new $29 million public service facility to improve municipal services to the ENTIRE city.

2. Redistricted municipal services areas to decrease the overload existing upon the former 3 plants.

3. Provided increased utility services to those areas which requested such action.

DEPARTMENT of PLANNING and ZONING:

Mr. D. Snoopy with the better interests of the city ever at heart and the city's recreational needs as first priority took the following progressive actions:

1. Using available department funds, bid on two large, attractive park parcels.
2. Also, ever attentive to community needs, he rezoned two areas crucial to the improvement of the N.E. sector (one for low-cost housing; the other for heavy industry).

DEPARTMENT OF TRANSPORTATION:

Miss G. Road Runner with her usual dedication for the betterment of the city, made the following decisions in close consultation with the city's constituents:

1. Rerouted a bus route to serve the increasing needs prevelant in the N.E. sector.
2. Added a new Type 2 road to service those citizens who will live in the new low-cost housing complex constructed by the progressive economic sector.

DEPARTMENT OF EDUCATION:

The Commissioner of Education, knowing full well how concerned BLUE CITY is with the education of its youth has decided to discuss his recent fantastic actions with the citizens at today's meeting.

BLUE CITY: A fair city with honest government working overtime to keep its citizens happy!!!!!!

APPENDIX F

URBAN STUDIES INSTITUTE

MANKATO STATE COLLEGE

June 22, 1971

BLUE CITY: COMPARATIVE ANALYSIS OF DEMOGRAPHIC & ECONOMIC STATISTICS

Reproduced from best available copy.

INPUTS	1	2		3		4		5	ROUNDS
Total Population	275,500	282,000	2.3	287,500	.9	294,500	2.4	303,000	2.9
Low	73,500	77,500	5.4	72,000	-7.6	72,500	.6	74,000	2.0
Middle	99,000	102,000	3.0	108,000	5.9	113,000	4.6	115,500	2.2
High	103,000	102,500	.5	107,500	4.9	109,000	1.4	113,500	4.1
Population per Residential Sq. Mi.	1,940	1,985	2.3	2,024	.9	2,073	2.4	2,089	.8
Developed Land (Sq.Mi.)	41	41	0	41	0	42	0	43	2.4
Total Assessed Value of Land	166	166	0	169	1.8	169	0	183	8.2
Average Dissatisfaction Level	0	122	112.0	108	-3.7	104	-3.7	115	10.5
Average Educational Level	60	58	-3.4	58	0	58	0	57	-1.7
Student-Teacher Ratio	14	14	0	14	0	14	0	14	0

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6		7		8		Total %
348,500 82,000 132,000 134,500	14 10.8 14.5 15.6	366,500 86,000 137,000 143,500	5.1 4.9 3.8 6.7	418,000 111,000 145,500 161,500	14 29 6.2 42.5	51 51 47 56.7
2.233	6.4	2.276	1.9	2,388	4.9	23
44	2.3	46	4	47	2	14
191	4.3	192	.5	194	1.0	16.8
127	10.4	130	2.3	164	26	
57	0	57	0	55	0	-9
15	7.1	15	0	16	0	-14

INPUTS	ROUNDS OF PLAY								
CITY INCOME TAX	1	2		3		4		5	
Prop. Tax Land	6,641,600	6,641,600	0	6,768,000	.9	6,741,600	-0.4	7,322,000	8.7
Prop.Tax Imp.	8,997,000	8,841,000	-1.7	8,937,600	9.9	31,431,400	251.7	37,757,300	20.1
Res.Inc. Tax	25,954,117	26,048,716	.4	25,870,296	-0.7	28,159,123	8.6	31,099,698	10.4
Emp.Inc Tax	0	0	0	0	0	0	0	0	0
Res.Auto Tax	203,134	203,477	.2	190,926	-6.5	217,972	14.2	280,765	29.3
Emp.Auto Tax	0	20,318		19,059	-6.6	21,768	14.2	28,045	28.8
Goods Sales Tax	2,547,168	2,715,592	6.6	2,788,821	2.7	7,636.393	173.8	8,299,162	8.7
Service Sales Tax	2,610,618	3,121,127	19.5	31,864,479	19.9	3,761,513	-747.1	3,723,568	-1.0
Out-standing Bond Payment (1)	7,240,000	7,240,000	0	7,240,000	0	16,070,000	120.0	0	0
(2)		10,780,000		10,780,000	0	0	0	0	0
(3)				16,070,000	0	0	0	0	0
(4)				0	0	0	0	0	0
TOTAL	7,240,000	18,020,00	148.3	34,090,000	89.1	16,070,000	-112.1		

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6		7		8		
7,615,600	3.8	7,080,400	8.5	7,756,000	.9	16
40,208,000	6.4	43,500,800	7.4	46,698,400	7.3	19
36,182,357	8.1	39,125,076	8.1	43,719,610	11	40
0	0	0	0	0	0	0
334,961	19.3	316,894	-5.0	332,679	5	18
33,453	19.2	31,648	-5.0	33,227	5	18
9,288,781	11.9	10,030,922	7.9	10,415,170	3.8	25
3,913,147	5	4,346,725	11	4,476,607	3	16
0	0	0	0	0	0	[illegible]
0	0	0	0	0	0	[illegible]
0	0	0	[illegible]	0	0	[illegible]
0	0	0	0	0	0	[illegible]

INPUTS	ROUNDS OF PLAY								
School Enrollment	1	2		3		4		5	
Public	57,250	59,210	3.4	57,620	-2.7	58,100	.8	58,150	.09
Private	11,950	11,500	-2.9	14,970	30.1	16,380	9.4	18,500	13.0
Number of Employed Workers	81,600	81,440	-0.2	80,400	-1.3	87,920	9.3	93,800	6.7
Low	25,200	24,200	-4.1	20,400	-18.6	25,600	25.5	29,600	15.6
Middle	31,680	32,640	3.0	34,560	5.9	36,160	4.6	36,960	2.2
High	24,720	24,600	-0.5	24,440	3.4	26,160	2.8	27,240	4.1
Number of Unemployed Workers	4,200	6,800	60.9	8,760	28.8	3,400	-157.6	0	0
Low	4,200	6,800	60.9	8,400	23.5	3,400	-157.6	0	0
Middle	0	0	0	0	0	0	0	0	0
High	0	0	0	360	360.0	0	0	0	0
% Earnings									
Under 5,000	38	36	-18.0	35	-0.3	38	12.0	34	-8.0
5-10,000	43	46	43.0	46	0	42	-16.0	40	-20.0
Over 10,000	17	17	0	17	0	19	1.9	24	3.0
Number of New Jobs	80	0	0	0	0	130	130.0	37	-251.3
Low	0	0	0	0	0	34		11	-209.0
Middle	0	0	0	0	0	49		11	-345.0
High	0	0	0	0	0	47		15	-213.0
Total Workers on Welfare	4,200	6,800	60.9	8,760	28.8	3,400	-157.6	0	0
Welfare Payment/ Worker	1,500	1,000	-50.0	1,000	0	2,500	150.0	2,500	0

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6		7		8		Total %
62,510	7	63,580	1.7	67,350	6	17
25,820	39	29,290	13.4	37,580	28.3	68
107,320	14	112,680	5	126,920	12.6	55
32,800	10.8	34,400	4.8	41,600	21	65
42,240	14	43,840	3.7	46,560	6.2	47
32,280	18	34,440	6.6	38,760	12.5	56
0	0	0	0	2,800	0	33
0	0	0	0	2,500	0	33
0	0	0	0	0	0	0
0	0	0	0	0	0	0
38	11	35	-8	36	2.8	-3.2
27	12	28	3.7	28	0	64
80	49	43	-46	66	60	
33	33	22	-30	32	45	
24	49	13	45	22	69	
23	32	8	-65	12	50	
0	0	0	0	0	0	0
2,500	0	1,600	-36	1,600	0	6.2

Chapter X

CITY MODEL:
THE MEMPHIS STATE EXPERIENCE

by

Robert Dean
Memphis State University

CITY MODEL:
THE MEMPHIS STATE EXPERIENCE

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CITY MODEL:
THE MEMPHIS STATE EXPERIENCE*

Introduction

During the spring semester of the 1970-1971 school year, a group of 16 graduate students from the Departments of Economics and Geography had both the privilege and pleasure of "playing" the City Model. With the exception of this writer, none of the students had ever participated in a simulation-gaming exercise, nor had they ever been given much exposure to the input-output media of computers (i.e., code sheets, punched cards, and computer printouts)! Despite these obstacles, the students found the interaction with the City Model a most rewarding experience and were eager to participate again in such a venture. Indeed, it was the opinion of most of the students that additional sessions with the City Model would be required if maximum benefits from the use of the Model were to be achieved. Simply put, their argument was that the more innovative uses of the Model can only occur after prolonged and extended play.

The decision to utilize the City Model as one of the principal teaching tools in the joint seminar with the Geography Department on urban problems was by no means accidental. Having used Alan Feldt's Community Land Use Game (CLUG) and Richard Duke's METROPOLIS in courses dealing with urban planning, I was well aware of the student interest and excitement in playing the roles of public and private decision makers in the urban arena. In the past, however, my experience with the use of simulation-gaming as a teaching device had been limited to undergraduate students. Moreover, I had never attempted a modeling exercise with the complexity and level of sophistication associated with the

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*The modeling exercises could not have been carried out at Memphis State without the support of the Bureau of Business and Economic Research. In particular, a great debt of gratitude is owed to Mr. David Gilles, a Research Assistant in the Bureau, for his untiring efforts in overseeing the modeling exercises. Without his contributions, the gaming sessions would not have been possible.

City Model. Therefore, I treated the use of the City Model as an experiment for the instructor as well as the students!

Because of my own limited experience in handling a modeling effort with the degree of complexity of the City Model, I decided to use a graduate seminar as the testing ground for the gaming experiment. I assumed (perhaps erroneously) that graduate students would more readily grasp the technical aspects of inter-acting with the City Model, and that they would be better able to make more meaningful decisions within the time span of one semester. Graduate students from both the Geography Department (the Geography Department offers a heavy concentration of courses in urban geography and planning) and the Economics Department were invited to participate in the seminar.* Because both the Geography and Economics Departments had a number of graduate students with full time jobs during the day, it was decided to hold the urban problems seminar at night. In retrospect, the decision to make the seminar available to the older, more mature graduate students was a good one. This particular group of students (roughly half the class were in this category) brought first-hand knowledge of the problems confronting the Memphis Metropolitan region. Equally important, they had had some experience in dealing with these problems locally and fortunately were able to transfer their work experiences in a useful and meaningful manner to those students who had had little work experience in the "real" world.

The course was officially designated as a Seminar in Current Economic Problems (Economics 7190) and was offered one night a week. Traditionally, the instructor or teacher of this seminar is given a great deal of freedom and latitude in course structure, therefore it seemed to be the course best suited for experimentation with the City Model. The students agreed to meet from 6:30 to 10:30 p.m. on Wednesday evenings, even though the required number of hours of class meetings would only have called for sessions from 6:30 to 9:30 p.m. It is also worth noting that the sessions were not held in the traditional classroom setting. Instead, a group of rooms and offices adjoining the University's Regional Economics Library and the Library itself were used for the gaming sessions. The more spacious conditions were instrumental in achieving a more realistic environment for role playing in the City Model.

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*Insofar as I can determine, this was the first experience at Memphis State in holding a joint course by departments in two different colleges. (The Economics Department is in the College of Business Administration, and the Geography Department is in the College of Arts and Sciences.)

The Course

The seminar in urban problems had three major objectives. The primary objective of the course was to improve the student's understanding of the nature and scope of such urban problems as chronic unemployment, poverty, housing shortages, crime and violence, inadequate health delivery systems, and so forth. Another important objective was to get the student to visualize the City's problems in "hollistic" or "systemic" terms. In other words, the aim was to encourage students to view the activities of the City as being closely related and interdependent (e.g., an unemployment problem will exacerbate a health problem, the loss of industry and jobs in the private sector will reduce the number and quality of services offered in the public sector through reduced tax revenues, etc.). A third objective was to encourage the student to use an interdisciplinary perspective when dealing with urban problems; that is, to look at the problem not only from the viewpoint of an economist, but also from the perspective of a geographer, planner, political scientist, etc.

The City Model was essentially used to help achieve all of these objectives. Based on my previous experiences with CLUC and METROPOLIS, I found that the actual experience of dealing with a land-use problem (e.g., zoning) makes the student more sensitive to the broader concept of land use planning. Thus, it was felt that the problems of housing, unemployment, education, health, etc., would be more readily understood by the students if they were able to work on these problems at the same time they were dealing with them within the traditional classroom and academic framework. It was also felt that a simulation-game of the City Model type would enhance the student's ability to view the City as a system of interconnected activities and institutions. Indeed, many of the outputs of this particular gaming model (e.g., land use maps, economic indicator tables, etc.) are designed in such a fashion that the City can be viewed more easily as a single entity than as several separate and disparate parts.

Through proper role-placement of students with different discipline backgrounds, it was also hoped that the modeling effort would help the students to broaden their perspective to include the thoughts and ideas of other disciplines when dealing with a particular problem. In this case, the advantage of the City Model is that it encourages interaction between the various role players, thus making it possible for a certain amount of "knowledge transfer" to take place between disciplines.

The seminar in urban problems was essentially developed along three lines. First, the students were asked to read a number of books dealing with urban issues and problems. These materials were then discussed throughout the semester and in conjunction with the modeling effort. Second, the students were assigned roles in the City Model and were expected to devote a major portion of their weekly class meetings to the gaming experiment. Third, each student was asked to prepare a research paper dealing with a particular local urban problem. Each student was also asked to present his paper at one of the class meetings so that all of the students would develop a certain sensitivity towards local issues and problems at the same time they were grappling with similar types of problems in the City Model.

Dynamics

Insofar as the utilization of the City Model is concerned, certain steps were taken to minimize the students' problems in mastering the mechanics of making decisions. One full classroom session was devoted to the discussion of the major decision-roles in the City Model as well as the many printouts and reports that result from each role player's decision inputs. During the first session, each student was assigned a particular role (i.e., social decision maker, economic decision maker, mayor, etc.) and asked to read that portion of the City Model manual dealing with his role. Using the manual as a guide, each student was also asked to fill out a decision sheet for the next class meeting and be prepared to answer questions concerning each type of decision that he(she) could make. Each student was also asked to maintain a diary on his particular decisions as well as keep a listing of any problems or criticisms he had of the gaming experiment. The diary proved to be quite useful, since both the student and instructor could review the decisions and the reasoning behind them over a number of gaming sessions. The diaries clearly revealed that as the students became more knowledgeable about their roles, they were able to make a greater number of decisions within a shorter period of time. The decisions in later rounds also appeared to be based on more information and a better understanding of their possible effects on the economic parameters of the model.

Concerning the play itself, the economic decision makers can best be described as rather conservative, cautious players. The aversion to risk-taking was especially noticeable in the early rounds when the students were quite uncertain as to the outcome of particular decisions. Insofar as I can determine, none of the economic decision makers had a "game plan." Most of the decisions in the early rounds were not made in a systematic fashion or developed in a coordinated manner. In later rounds, however, many decisions were made as a result of actions taken in earlier rounds. For example, an economic decision maker would build some housing units for rental purposes and then find they were underutilized. He (she) would then consider building commercial or manufacturing establishments close by in order to induce more people to live in the underutilized housing units and build up a good supply of labor. Just as likely, the procedure would be reversed, and the emphasis would be on building housing units near a previously built manufacturing plant in order to maintain an adequate supply of labor close to the plant.

Most of the economic decision makers made good profits on their business operations, although losses on particular investments were not uncommon. It was also evident that profit maximization was the primary motive for making decisions, subject, of course, to the twin constraints of risk-taking and uncertainty.

The social decision makers did not have an opportunity to exercise their voting power, therefore they spent much of their time trying to improve social conditions in the City. A few boycotts on retail establishments were attempted, but for the most part, their approach was to use "moral persuasion" on public officials and economic decision makers to change their attitudes toward problems such as poverty, poor housing, job discrimination, etc. The social decision makers did succeed in getting the mayor to establish a housing task force to investigate the poor housing conditions in the City. As we shall see shortly, this particular task force was quite instrumental in getting "slum" landlords to improve and upgrade their properties.

The public decision makers made a concerted effort to improve the welfare of the City, although the indicators used to measure economic progress do not clearly reflect the intensity of this effort. During the early rounds, the "game plan" was to obtain additional revenue to upgrade the school system and municipal services, while at the same time bring about a redistribution of the tax burden so that it would fall more heavily on the business community and to a lesser extent on the work force. Lower income residents also received a tax break through the reduction of sales taxes on goods and services while the tax on auto owners was raised in the hopes that the use of public transportation would increase.

A substantial public deficit in the early rounds, however, caused the public decision makers to modify their target objectives until the deficit was significantly reduced. By the sixth round, the deficit was under control, and the earlier effort to improve the quality of municipal services and the school system was renewed. During this round, a serious review was also made of the City's more pressing problems. As a result of this review, it was decided that more park and recreational land was needed for the City, and money was appropriated to the planning and zoning department for this purpose. Rising complaints from the social decision makers about the high tax rates on lower income residents and their deplorable housing conditions prompted the mayor to lower the residential income tax rate and the employee income tax rate. In addition, the mayor appointed a committee to review the housing conditions in the City and provide him with recommendations concerning the proper resolution of this problem.

In the last round, an election was held, and the incumbent mayor lost to one of the economic decision makers who was dissatisfied with the higher taxes on business properties and the move towards a "socialist" form of government. Unfortunately, the new mayor did not have time to carry out his conservative policies since the gaming sessions had to be halted due to the end of the school semester!

A review of some of the economic and demographic growth trends reveals a fairly successful performance for the City's economy. Figure 1 below illustrates some of these trends. Chart 1-A and 1-B indicate that the population increased 52 percent and employment 46 percent over the eight round of play. Thus, the City appears to have grown at a fairly steady rate with population at a little over 6 percent per annum and employment slightly less at 5 percent annually. The unemployment chart shows little or no unemployment from round 3 through round 7 of play, thereby indicating a full employment economy over most of the gaming sessions. Although unemployment was quite low (except for round 8), Chart 1-C indicates that the proportion of workers earning less than $5,000 actually increased from 38 percent to 40 percent of the total work force during the gaming sessions. This is somewhat alarming, since this group of wage earners are largely unskilled and semi-skilled and are not capable of being absorbed into more capital-intensive industries (with higher wage rates) without considerable retraining and additional education.

Despite this apparent weakness in the structure of the work force, it is evident that the social welfare of the community improved considerably during the period of play. As Chart 1-E indicates, per capita income has risen steadily during the gaming session. As of the end of the seventh round, per capita income had reached $2,000, a 17 percent increase over the base year figure. This improvement was extremely encouraging to the students, especially those that played the role of social decision maker.

With regard to certain key economic indicators, then, the City appeared to be better off at the end of the gaming sessions than at the start. It is extremely difficult, however, to single out one particular factor that contributed most to this improvement in economic well-being. Perhaps it was due to the rather conservative manner in which the public and private decision makers made decisions. Possibly it was due to the fact that the national economy was fairly

Figure 1

ECONOMIC AND DEMOGRAPHIC TRENDS

Chart 1-A
Population Growth

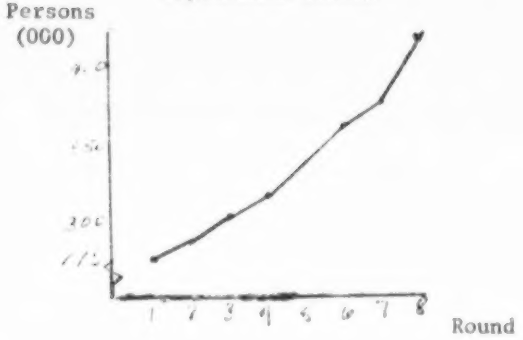

Chart 1-B
Employment Growth

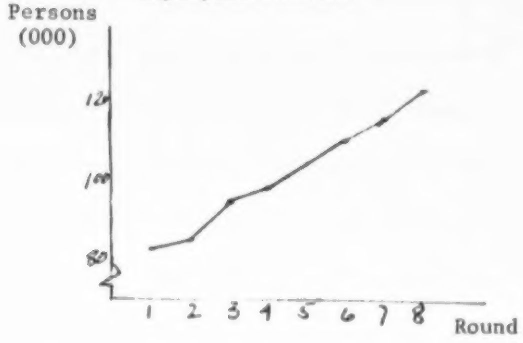

Chart 1-C
Unemployment Trend

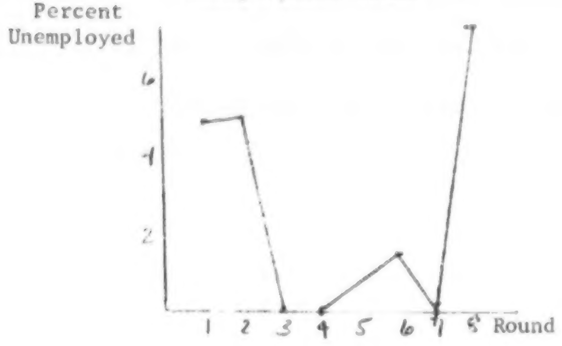

Chart 1-D
WAGE DISTRIBUTION

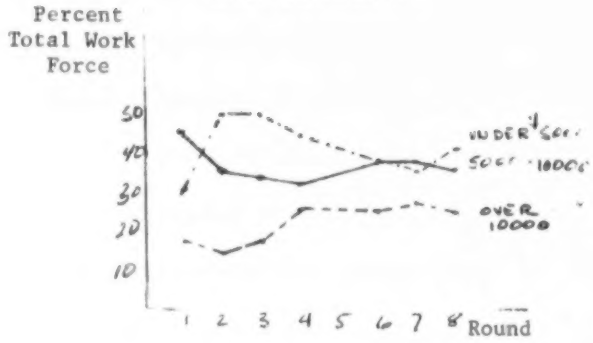

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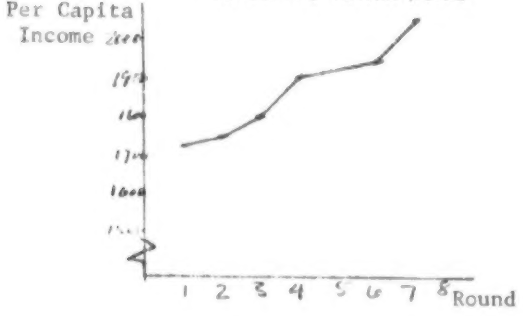
Chart 1-E
Per capita income trend



strong during the gaming sessions and therefore gave added strength to the local export sector. Regardless of the causes, the students were most delighted to achieve the twin objectives of full employment and rising per capita income--a most unlikely occurrence in the real world!

CONCLUSIONS

It should be made perfectly clear to the reader that no attempt was made to measure with precision the importance of the City Model as a learning tool. Because others have traveled this road before and have not really had much success in isolating the contributions of simulation gaming to the learning process, I find it expedient to withhold any comments on the degree of usefulness of the City Model except to say that the modeling effort was an extremely worthwhile experience in group interaction and certainly the highlight of the seminar.

In reviewing the course in more realistic terms, it is fair to say that we were moderately successful in meeting the three course objectives. Based on the results of the research papers and the class discussions that took place before and after the gaming sessions, it was clear that most of the students had a better understanding of some of the gut issues facing our cities at the end of the course than they did at the beginning. Although I cannot support this contention with empirical evidence, it seemed to me that the background readings, modeling exercises, and research papers are complementary learning activities, i.e., one reinforces the others. In this particular case, the background readings provided a basic frame of reference for the role players in the modeling effort, while the modeling effort increased the students' sensitivity and awareness towards certain urban concepts and problems. In turn, a heightened awareness of a particular problem made it easier to construct and implement a research design related to that problem.

The students also became more cognizant of the fact that the City is a system of interdependent activities, although not with the degree of sensitivity and understanding that I had hoped for. The lack of real success here, however, cannot be blamed on any inherent weakness in the City Model, but rather on the failure of the instructor to create opportunities for the students to use the Model's structural relationships to better advantage.

The problem boils down to this: most of the students were so involved in their own roles that they had little time or interest in viewing the City as a single entity or investigating the relationships between different sectors of the economy unless their role required them to do so. To compensate for the students' lack of "integrating" experiences, some of the "rap" sessions concerning the modeling exercises focused attention on the concept of the City as an integrating mechanism. Another approach, and one that appeared to have greater utility, was to establish policy task forces to review a certain problem or issue. One of the more interesting task forces was the Housing Commission. This particular task force consisted of three students, and its objective was to determine the conditions of housing in the City Model and what if anything needed to be done to improve these conditions. After a thorough analysis of maintenance levels on housing, the Housing Commission recommended that all housing in the City have at least a .50 maintenance level. The economic decision makers, of course, balked at this proposal because it would cut down on their profits and in many cases result in substantial losses in particular housing units.

Thus, the conflicting issues of economic profit and social welfare were joined, and after several hours of heated debate, the problem had still not been resolved. Eventually, a new mayor reached a compromise with the economic decision makers whereby the City would pay them subsidies to improve and rehabilitate their properties. The beauty of this particular exercise, however, lay not in the solution to the problem, but in the process through which the problem was resolved. The students on the housing task force had to view the problem of poor housing conditions as essentially a problem for the whole City to resolve, but in recommending solutions it also had to come to grips with the fact that certain groups or economic classes (e.g., slum landlords) would not benefit personally from these decisions. Because of the conflicts that result when one vested interest group stands to lose at the expense of another, most of the students gained a better appreciation for the problems of developing a citywide policy on housing standards as well as the delicate relationship between housing conditions and economic profit.

The attempt to create an interdisciplinary perspective in urban problem solving did not meet with much success. Unfortunately, the structure of the City Model does not promote this type of learning process nor does it mitigate against it. Once again, if the instructor is innovative, a number of ad hoc task forces which are multi-disciplinary in makeup can be established to consider urban problems within an interdisciplinary framework (e.g., a task force on transportation policy would include a sociologist, political scientist, geographer, planner, engineer, and an economist). However, most students--even graduate students--have not progressed to the point where they can develop on their own comprehensive solutions to a problem as complex as urban transportation; therefore, the task forces would need faculty support. In turn, this would require a team teaching effort, which was logistically not possible for this particular seminar.

Summing up, even though the objectives of the course were not completely achieved, it would be unfair to say that the City Model was mainly responsible for this lack of achievement. It should be kept in mind that this was an experiment for both the instructor and the students, and that in subsequent sessions, more effective and innovative uses of the City Model would result in higher achievement levels. As I see it, however, the main problem with the use of City Model is the inability to manipulate the key parameters of the Model (e.g., economic growth rates, social conditions, production capacities, etc.), thereby making it more flexible and susceptible to innovative approaches to urban problem-solving.

In order to create this type of learning environment, the students and the instructor must know more about the inner workings of the Model itself. In turn, this calls for the computer programs that form the basis of the City Model to be housed at the college or university carrying out the modeling experiment. The location of the City Model at each participating university would also increase the frequency of interaction with the City Model. Moreover, the laborious process of mailing decisions to Washington, D. C., and then waiting a week or more for the results of these decisions tends to have a dampening effect on the students' interest and attitude towards the modeling exercise. Indeed, the most common complaint heard during the modeling experiment was Why Can't We Get the Results of Our Decisions Tomorrow? Although this is probably a universal complaint and not easily solved without terminal devices and "real time" or "shared time" computer processing capabilities, the problem of "output" delay would be less severe if handled locally.

There is also a need to feed local demographic and economic statistics into the City Model so that students can actually work on problems that are both important and extremely familiar to them. This can best be done by transferring the City Model to the local university or college carrying out the modeling experiment.*

The other criticisms that we have of the City Model are minor in nature and mostly have to do with the mechanics of "playing the game." The majority of the students felt that the player's manual was overly complex, and that the sections dealing with individual roles should also include decision input formats, the procedure for making decisions, and those computer printouts most important to a particular role (decision maker). Another frequently heard complaint was the inability to go to one source or computer printout sheet for needed data. Although this is not possible to achieve under the present reporting system, some additional consideration should be given to the data needs of each role player and whether or not more realistic data combinations can be developed. For example, it would be extremely useful for the player operating the bus company to have the geographical locations of the labor force and the work sites combined one one printout sheet. There was also a strong feeling among the students that the social decision makers were quite limited in the number and types of decisions they could make, and that this particular role should be either expanded greatly or dropped completely in favor of new roles that emphasize the activities of agencies dealing with health and welfare problems.

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*At Memphis State, we would like to load 1970 Memphis block and tract data on population and housing into the City Model, develop local population and land use growth patterns, and in general operate the Model as a replicate of the local development process.

As indicated above, however, these criticisms do not materially detract from the basic strengths of the City Model. Indeed, our interest in City Model is very high, and we are anxiously looking forward to continued interaction with the Model during the next school year.

Chapter XI

CONCLUSION

City Model was designed to be a non-scoring game. This conceptualization of the purpose of the model meant that a comparison of the outputs of the model was not really possible, except in a superficial fashion because each of the users was expected to decide his own optimal strategy for the "best" city.

However, to partially satisfy the very natural urge to compare the model runs anyway, Figure 5 was prepared. The reader is invited to do his own analysis in terms of the most desirable city.

From the terms of the model structure, it is interesting to note not the differences, but the tendency to converge -- the similarities in the macro-statistics despite minor alternatives in individual strategies. Most notable are the population and income distribution figures.

Figure 5

Round 8 Data

	Start	American	Dartmouth	Georgetown	Mankato	(Round 7) Memphis
I Population						
Low Income	73,500	117,500	116,500	116,500	111,000	105,000
Middle Income	99,000	145,500	166,000	173,000	145,500	127,000
High Income	103,000	165,000	166,000	173,000	161,500	142,500
Total Population	275,500	428,000	448,500	462,500	418,000	374,500
II Land Use						
Developed Land (sq mi)	41	51	50	52	47	46
Density Per Sq Mi	440	684	717	740	668	599
Total Assessed Value Land	166,000,000	273,000,000	279,000,000	259,000,000	194,000,000	177,000,000
Total Assessed Value Develop.	450,000,000	852,000,000	950,000,000	1,149,000,000	667,000,000	527,000,000
Residential Vacancy Rate	6%	6%	-2%	0	-4%	-5%
III Income						
Sales to National Economy						
Heavy Industry	469,908,000	532,950,000	501,748,200	723,455,400	620,160,000	494,000,000
Light Industry	203,032,500	473,800,000	539,302,850	565,835,650	438,265,000	304,980,000
National Services	207,900,000	572,000,000	223,080,000	457,600,000	205,920,000	298,900,800
Balance of Trade	(17,081,250)	478,629,825	175,544,446	647,811,623	356,791,589	268,117.932
Total Employed	81,600	133,160	139,560	131,480	126,920	116,840
% Unemployed	4.90	0	0	0	2.16	0
Welfare Recipients	4,200	0	0	0	2,800	0
Income Distribution (Under $5000/$5-10,000/Over $10,000)	38/43/17	36/34/28	37/35/28	35/32/31	36/35/28	35/37/26
IV Finance						
Taxes Per Capita	184.34	230.09	203.15	258.95	271.37	372.89
Bond Payment Per Capita	46.20	127.59	16.68	6.90	107.61	10.49
Total Annual Bond Payment	12,727,656	54,610,000	7,480,000	3,190,000	44,980,000	3,930,000

Acknowledgments

The concept of a social science laboratory was another of those "buzz" words which appear to mean everything and at the same time nothing. When the group of us at Envirometrics began to advocate such an idea for universities and colleges, it was immediately accepted in a fuzzy sort of way.

For two years we worked on a computer-based model which could be used both for research and training purposes. When we thought we had accomplished this end we approached the National Science Foundation for a research grant.

Upon approval, the grant was used to test the concept of a general social science lab by having several disciplines use the same model to teach their extant courses.

This report is the result of that experiment. The story and results are told directly by each professor, except for some overall comments I made myself.

The usefulness of this lab is for each reader to decide. Our thanks go to those professors who tested the laboratory concept and who are now able to help guide the way for others.

Peter House
President
Envirometrics, Inc. 1971

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